November 2009

ASIAN CARP Rapid Response Plan

Produced by:

ASIAN CARP RAPID RESPONSE WORKGROUP

ASIAN CARP
Rapid Response Plan

November 2009

Produced by:

Asian Carp Rapid Response Workgroup

CONTENTS

Section Page

ACKNOWLEDGEMENTS iv

1.0 SITUATION 1
1.1 PURPOSE 1
1.2 SCOPE 2
1.3 MISSION 2
1.4 GENERAL 2
1.5 THREAT ASSESSMENT 4
1.6 CONSIDERATIONS AND ASSUMPTIONS 5

2.0 EXECUTION 6
2.1 RESPONSIBILITIES 6
2.1.1 Functional Responsibilities Matrix – Rapid Response* 6
2.2 PRIMARY RAPID RESPONSE PLANNING ORGANIZATIONS 7
2.2.1 Illinois Department of Natural Resources (IDNR) 7
2.2.1.1 Illinois DNR Office of Law Enforcement - Conservation Police 7
2.2.2 United States Coast Guard (USCG) 7
2.2.2.1 USCG Sector Lake Michigan, Milwaukee 7
2.2.2.2 USCG Marine Safety Unit (MSU) 8
2.2.3 Metropolitan Water Reclamation District of Greater Chicago 8
2.2.4 United States Army Corps of Engineers (USACE) 8
2.2.5 United States Environmental Protection Agency (USEPA) 8
2.2.6 United States Fish and Wildlife Service (USFWS) 8
2.3 SUPPORTING RAPID RESPONSE PLANNING ORGANIZATIONS 9
2.3.1 Great Lakes Fishery Commission (GLFC) 9
2.3.2 City of Chicago 9
2.3.3 International Joint Commission (IJC) 9
2.3.4 Midwest Generation, LLC 9
2.3.5 Affected Counties 9
2.3.6 Other Support State and Provincial Agencies 10
2.4 CONCEPT OF OPERATIONS 10
2.4.1 Response Trigger 11
2.4.2 Rapid Response Operations 11
2.4.2.1 Preparedness Phase 11
2.4.2.2 Response Phase 11
2.4.2.3 Recovery Phase 12
2.4.3 Other Control Actions 12
2.4.4 Reverse Trigger 12
2.5 COORDINATING INSTRUCTIONS 13
2.5.1 Incident Command System (ICS) 13
2.5.2 Interagency Coordination (See Annexes 1 and 2) 14
2.5.3 Key Points of Contact 14
2.5.4 Rapid Response Plan Activation 14
2.5.4.1 Roles and Responsibilities 14

CONTENTS

Section Page

2.5.5 Treatment Selection 17
2.5.6 Site Safety and Security 17
2.5.6.1 Rapid Response Safety Guidelines 18
2.5.6.2 Safety Briefing 18
2.5.6.3 Hazards 18
2.5.6.4 Staging and Treatment Areas 20
2.5.6.5 Response Security 21

3.0 ADMINISTRATION AND LOGISTICS 23
3.1 ADMINISTRATION 23
3.1.1 Concept of Support 23
3.1.2 Cost Capturing and Funding 23
3.1.3 Legal Considerations 23

4.0 COMMUNICATIONS 24
4.1 UNIFIED COMMAND 24
4.1.1 Joint Information Center (JIC) 24
4.1.2 Federal, State, County, and Local Operation Centers 24
4.1.3 Communications Capabilities 24
4.1.4 Communications Procedures 24
4.1.5 Alert and Notification 25
4.2 SIGNAL 25
4.2.1 Administrative Reports 25
4.2.2 Public information 26
4.2.3 Interoperable Communications Assets 26
4.2.4 Interoperable Communications Systems Worksheet 26

5.0 FUTURE MITIGATION 27
5.1 SOUND PROJECTOR ARRAY DRIVEN BIOACOUSTIC FISH FENCE SYSTEM 27
5.2 INTERCONNECTIVITY TO THE CSSC 28
5.2.1 I & M Canal 28
5.2.1.1 Current Status 28
5.2.1.2 Recommended Mitigation Efforts 29
5.2.2 Des Plaines River 29
5.2.2.1 Current Status 29
5.2.2.2 Recommended Mitigation Efforts 30

6.0 EXERCISE AND TRAINING 31
6.1 TRAINING 31
6.1.1 Key Training Objectives 31
6.1.2 Goals 31
6.2 EXERCISE 31

CONTENTS (Continued)

Annex 1: Lockport Pool to RM 296.7 Rapid Response Operations

Annex 2: Des Plaines River Rapid Response Operations

Appendices

A Figures 1 through 5
B Resources and Assets for All Locations
C Health and Safety Information (to be included with revised plan)
D Site Security Plan (to be included with revised plan)
E Notification and Contact Information
F Treatment Matrix and Elimination Criteria
G Chemical Application Procedures
H Regulatory Requirements and Agency Permitting
I Risk Analysis
J Antimycin A and Rotenone Data and Sensitivity Study
K Lockport Pool Treatment Area Biomass Estimate
L Detoxification and Neutralization Information
M Chemical MSDS Information
N Interagency Agreements/MOUs/MOAs (to be included with revised plan)
O Acronyms and Glossary
P References

ACKNOWLEDGEMENTS

The Asian Carp Rapid Response Workgroup consisted of the following members:

Agency/Stakeholder	Representative
Chicago Department of Environment	Kevin Schnoes
Great Lakes Commission	Kathy Glassner-Shwayder
Great Lakes Fisheries Commission	John Dettmers Marc Gaden
Illinois Department of Natural Resources	Steve Shults John Rogner
International Joint Commission	Mark Burrows
Metropolitan Water Reclamation District of Greater Chicago	Michael Sopcak James Yurik
Midwest Generation	Julia Wozniak
United States Army Corps of Engineers	Charles Shea Colonel Vincent Quarles
United States Coast Guard	MSTC Gregory Morris Commander Timothy Cummins
United States Department of Agriculture - Animal and Plant Health Inspection Service	Dr. Kathleen Burda
United States Environmental Protection Agency - Great Lakes National Program Office	Bill Bolen
United States Fish and Wildlife Service	Michael Hoff Sam Finney
Wisconsin Sea Grant	Phil Moy

Photograph of Jumping Asian Carp Provided by Nerissa Michaels, Illinois Natural History Survey

1.0 SITUATION

1.1 PURPOSE

In response to the increasing threat of the Asian carp expansion toward the Great Lakes and these fish placing greater pressure on barriers already in place to restrict their movement, the Asian Carp Rapid Response Workgroup was created. The purpose of the Workgroup was to assess the current situation and recommend courses of action should a rapid response be necessary to deal with Asian carp in areas of the Chicago Sanitary and Ship Canal, Des Plaines River, and the Illinois and Michigan Canal. In preparation for such a response, the Asian Carp Rapid Response Plan was created. At the request of partner agencies, the Illinois Department of Natural Resources (IDNR) has agreed to coordinate response actions and to serve as lead agency during response Operations.

The purpose of this plan is to establish, coordinate, and document actions by IDNR and its partner agencies to reduce the vulnerability of the Great Lakes to an Asian carp invasion via the Chicago Sanitary and Ship Canal (CSSC) and nearby bodies of water including the Des Plaines River and the Illinois & Michigan Canal (I&M). In the short term the purpose of rapid response measures, i.e. piscicide treatment, will accompany barrier maintenance, relieve pressure on Electric Barrier I (within the Lockport Pool), confirm presence of Asian carp previously detected through eDNA sampling and analysis, evaluate the feasibility and utility of applying piscicide in the CSSC to reduce or eliminate Asian carp populations, and validate the effectiveness of utilizing NIMS ICS concepts and principles of response for this type of effort via a multijurisdictional approach. In the long term permanent tools, such as piscicide treatment, would need to be implemented to mitigate the risk of Asian carp accessing Lake Michigan and the other Great Lakes.

This plan outlines the responsibilities and support of federal, state, and local agencies, as well as partner entities. The plan also describes the response procedures necessary for protecting and maintaining the integrity and safety of the Great Lakes ecosystem, and ensuring the health and safety of responders. These aims will be accomplished by implementation of the following actions:

- Confirmatory identification and increased surveillance efforts
- Selection and isolation of target areas to maximize control or eradication of Asian carp
- Examination of the pros and cons of all response options
- Provision of risk communication, notifications, health alerts, and public information to all necessary audiences
- Coordinated rapid response in the target area to control the upstream spread of Asian carp via the CSSC and nearby bodies of water
- Post-treatment monitoring to ensure thorough response.

Subsequent to the initiation of any actions in conjunction with a rapid response an Incident Action Plan (IAP) will be developed. The IAP will include the following:

- Operational objectives and briefing information
- Organization and chain of command
- Available resources
- Status updates
- Additional safety/hazard information.

1.2 SCOPE

This rapid response plan focuses on three locations along the Des Plaines River, Illinois & Michigan (I & M) Canal, or the CSSC (Appendix A, Figures 1 through 5), including the divergence into the CSSC and beyond. These locations are:

- Lockport Lock and Dam to River Mile (RM) 296.7 encompassing the following:
  - Areas between the electric barriers
  - Scenario of Electric Barrier shutdown or maintenance
- Des Plaines River at RM 297.0 upstream to RM 302.5
- I & M Canal from its confluence with the Brandon Road Pool of the Des Plaines River to the Cal-Sag Channel convergence

In the future it may be necessary to plan for rapid response actions encompassing the area beyond the electric barrier system to Lake Michigan, however at this time an effective treatment plan for this area has not been formulated.

1.3 MISSION

Through the Asian Carp Rapid Response Workgroup, the State of Illinois, with support from federal and local agencies, and other private entities will implement procedures and actions to protect and maintain the integrity and safety of the Great Lakes ecosystem from an Asian carp invasion via the CSSC, and to ensure the health and safety of responders and that of local personnel and residents.

1.4 GENERAL

The introduction of aquatic invasive species (AIS) into the Great Lakes and inland waterways throughout the United States is occurring at an alarming rate. Since the 1800s, over 180 species of AIS have made their way into the Great Lakes region. These fish, macrophytes, invertebrates, viruses, bacteria, and parasites can devastate native populations, as well as cause great economic damage to the Great Lakes commercial, sport, and tribal fisheries collectively valued at more than $7 billion annually (Barnhart, 2005). Of critical concern currently are Asian carp, a term used to describe a group of exotic fish originating in eastern Asia, that are expanding their range north through the Mississippi River basin towards the Great Lakes. Historically, successful control of AIS has resulted from focusing on small water bodies or critical control points in a system. The CSSC, which links the Great Lakes with the Mississippi River basin, is one such critical control point.

Historically, poor water quality in Chicago's urban waterways had controlled the transfer of invasive species between the Great Lakes and Mississippi River watersheds. Over the last three decades, newly created legislation and regulations aimed at improving water quality combined with government projects focused on habitat restoration, considerable improvement in water quality has resulted in an increased abundance of aquatic life in Chicago's waterways (Friends of the Chicago River, 2006). The man-made waterways in Chicago now form pathways for invasive species to expand their distribution between the Great Lakes and the Mississippi River System.

Asian carp are members of the family Cyprinidae. The three species identified for action under this plan for rapid response are the silver carp, bighead carp, and black carp. These fish were originally imported, along with grass carp, to southern United States aquaculture and wastewater treatment facilities to keep retention

ponds clean and to serve the food fish industry. Flooding throughout the 1980s and 90s allowed these fish to escape to nearby waterways. The bighead and silver species of carp are expanding their range north toward the Great Lakes. During 2002 monitoring efforts, Asian carp were detected in the upper Illinois River, just 60 miles from Lake Michigan (Conlin, 2002), and in 2009, silver carp were spotted considerably closer, within the Brandon Road Pool of the Des Plaines River.

Bighead carp can grow to very large sizes of over 5 feet in length that may approach 100 pounds or more. These filter-feeding fishes have "gill rakers" which are specially adapted for filter feeding and are capable of consuming 40% of their own body weight in food each day. Although these fish are excellent choices to keep aquaculture facilities clean, in the wild their eating habits allow them to quickly out-compete both small and large native fish such as the paddlefish, gizzard shad, lake perch, and buffalo fish. Sexual maturity is reached between 2-7 years dependent on the climate of the region (USGS, 2005). Upon reaching sexual maturity, they begin spawning anytime between April and September and can spawn multiple times during each season for the remainder of their life. These fish generally live about 10 years.

Silver carp are generally smaller than bighead carp. These highly prolific fish are similar to bighead carp in their feeding and spawning habits. Silver carp are often referred to as "flying fish" and pose a great danger to boaters, anglers, and other recreational users—of great concern on the Great Lakes. These fish are disturbed by boat motors and will jump from the water when startled. A motor boat traveling at high speeds causes these fish to jump from the water, potentially causing damage to boats and serious injuries to humans onboard.

Black carp differ from bighead and silver carp in both diet and appearance. They have large distinctive scales that are darker in color than those of the grass carp. Their pharyngeal teeth are large, resemble human molars and are specially adapted for crushing mollusk shells. The largest black carp on record in its native China is over 7 feet long and 150 pounds. Black carp were originally introduced in the United States accidentally in shipments of grass carp and are suspected to have escaped into the open waters of the Osage River in Missouri from an aquaculture facility during flooding events in 1994. The diet of the black carp, though different from the bighead and silver carp, makes them an equally deadly threat to the waters of the Great Lakes. Black carp consume mollusks and snails; adults can consume an average of 3 to 4 pounds of mussels per day. A single black carp could eat more than 10 tons of mollusks during its life. Black carp could aid in the reduction of invasive zebra and quagga mussel populations throughout the Great Lakes; however, native mussel populations (some of which are already known to be threatened or endangered) would also be negatively impacted in a relatively short period of time. The United States Geological Survey (USGS) has two documented reports of black carp in Illinois. The first specimen was caught in Horseshoe Lake, the second along the Mississippi River at Lock and Dam 24 in Calhoun County in 2004. Though not as widely distributed as the silver and bighead species, black carp remain a threat because juveniles are not readily distinguished from grass carp, which are sold and distributed throughout the United States and may be released into open waters (Nico, 2007).

Current Mitigation and Monitoring Efforts

A series of lock and dam systems along the Illinois Waterway have acted to slow the northerly progress of the Asian carp, and two electric barriers are in place as lines of defense against transfer of AIS between the Great Lakes the Mississippi River Basin. The three lock and dam systems—the Dresden Island Lock, the Brandon Road Lock and Dam, and the Lockport Lock and Dam (LL&D)—all have corresponding pools just upstream.

The two electric barriers in place are: Barrier II A, located upstream of the Lockport Lock and Powerhouse within the CSSC at river mile 296.1; and Barrier I, located upstream of Barrier II at river mile 296.35, see Figure 1 for barrier locations. A third electric barrier, Barrier II B, is under construction 500 feet upstream of Barrier II A, between the two existing barriers; completion of Barrier II B is anticipated in 2010.

In August 2009, as part of its expanded Asian carp monitoring program, the U.S. Army Corps of Engineers (USACE) began utilizing a new technique for sampling Asian carp by detecting Asian carp environmental deoxyribonucleic acid (eDNA) in water. Approximately 150 water samples were collected from both the Dresden Island pool and the Brandon Road pool. Preliminary test results detected silver carp DNA on July 31, 2009, in the Brandon Road Pool near the Lockport Lock and Powerhouse. This was the first indication of Asian carp this far upstream in the upper Illinois Waterway, and a single silver carp was observed by an electrofishing crew near this location on August 26, 2009. Subsequent eDNA testing in September 2009 also indicated the presence of silver carp within the Lockport Pool less than 1 mile from electric barrier IIA, as well as in the Des Plaines River several miles in from its confluence with the CSSC and about 5 miles upstream of where the electric barriers are located along the CSSC. No visual detections were noted within these areas.

Current efforts to gather additional water samples for more DNA testing are being supplemented with increased monitoring via electrofishing and other traditional methods with in the Lockport Pool of the CSSC, areas of the Des Plaines River, and the I & M Canal.

The Des Plaines River and the I & M Canal are of particular concern due to their proximity to the CSSC in areas above the electric barrier system (see Figures 1-5). Under flooding conditions that have occurred in the past (most recently in 2008), overflows connect the Des Plaines River with the CSSC. Fish could swim through flood waters into the CSSC, bypassing the electric barrier system to gain access to the Great Lakes. The I & M canal contains culverts that provide drainage from the area and then flow into the CSSC upstream of the electric barrier system. During times of flooding and high waters, these culverts are also a threat because fish may be able to swim into the CSSC above the barrier system, allowing them access to the Great Lakes. Currently, the USACE is conducting studies along both of these areas to delineate the extent of these areas and what mitigation efforts must occur to allow fish of varying sizes to pass from one body of water to the other.

1.5 THREAT ASSESSMENT

The Great Lakes cover more than 94,000 square miles. Following introduction of Asian carp into the Great Lakes basin, controlling their spread throughout the lakes would be nearly impossible. Establishment of Asian carp in the Great Lakes would have lasting and potentially negative effects. The favorable conditions found in the Great Lakes such as water temperature, food abundance, slow moving wetland regions, expansive area for migration, and lack of natural predators mean Asian carp populations could expand throughout the Great Lakes. Given the vast area of the Great Lakes eradicate would be very unlikely. These species could significantly impact local ecosystems.

The Great Lakes are home to many important species of food fish such as whitefish, bloater chubs, yellow perch, and rainbow smelt, as well as sport fish including trout, salmon, and walleye. The potential impact of Asian carp on the Great Lake's sport and commercial fishing industry is currently observed along the Mississippi River basin. In just a few short years following introduction of Asian carp into an area, many commercial fishing locations have been abandoned, because native fish have nearly disappeared from the catch, and replaced by Asian carp. The presence of Asian carp is a concern because they are prolific, grow and mature quickly, and feed on plant and animal plankton (the base of the food web). They may alter energy flow in a semi-oligotrophic system such as the Great Lakes, which in turn could lead to undesirable consequences for sport and commercial fisheries. In a 2002 workshop convened by the Great Lakes Protection Fund, the introduction of Asian carp into the Great Lakes ecosystem was identified as a threat to both sport and commercial fisheries, and a potential cause of ecological

and economic damages far exceeding those caused by the sea lamprey and zebra mussel invasions. (Chick, 2002)

The Great Lakes are home to nearly 80 federally listed threatened or endangered fish, mollusks, plants, mammals, insects, and reptiles, and many more species listed as threatened or endangered at the state level. The current invaders of the Great Lakes have been implicated in adverse effects on up to 46% of the local federally listed endangered plant and animal species. Introduction of Asian carp to the region could further harm these organisms and perhaps lead to their extirpation. One such fish of concern is the Lake Sturgeon, *Acipenser fluvescens,* which is protected by the State of Michigan because its remaining populations are less than 1 percent of the original population due to overfishing and habitat loss. Lake Sturgeon age to nearly 25 years for females and 12 years for males before reaching sexual maturity, and are bottom feeders with a diet including snails, mussels, and crustaceans (Michigan Sea Grant, 2009). They would be especially vulnerable to the introduction of black carp, with which they would directly compete for food.

1.6 CONSIDERATIONS AND ASSUMPTIONS

- This Plan is for rapid response made necessary by an invasion of Asian carp in one of the target areas described above (see Section 1.2). Current strategic actions to enhance preparedness prior to an introduction of Asian carp include the construction and activation of the electric barrier system along the CSSC. Near-term proposed strategic actions are discussed in Section 5.0 of this Plan.
- The CSSC is a federal navigable waterway; as such relevant federal regulations and authorities must be considered.
- An Asian carp rapid response event may occur at any time, depending on the weather and the response action taken, and changes in responsibilities and modifications to existing procedures may be necessary for operational success.
- Coordination of bi-national, federal, state, local, non-governmental organizations (NGO) and private industry partner stakeholders will be required.
- The State can apply resources and expertise to meet response-related needs beyond the capabilities of local jurisdictions.
- Federal capabilities and resources can meet disaster-related needs and augment state efforts, particularly if responses are beyond the capabilities of the State.
- NGOs and private industry can lend support to the rapid response mission and further augment governmental actions.
- Integration of planning, training, and exercises among all parties is imperative.
- The IDNR and all involved agencies must be familiar with the treatment procedures to avoid duplications or gaps during response operations and to respond in a coordinated manner.
- Many jurisdictional authorities coincide in the potential response areas, necessitating collaboration in a rapid response. This coordinated response may be arranged prior to such events through mutual-aid agreements (memoranda of understanding [MOU] / memoranda of agreement [MOA]) or other formal agreements with other stakeholders and agencies.
- Successful control of Asian carp under the scope of this plan may require additional interim and long term mitigative measures.
- Long-term monitoring and control of Asian carp will require a separate management plan developed cooperatively by all stakeholder agencies.

2.0 EXECUTION

2.1 RESPONSIBILITIES

The following sections outline the responsibilities and intentions of all participating agencies and stakeholder entities in an Asian carp rapid response operation.

2.1.1 Functional Responsibilities Matrix – Rapid Response*

Rapid Response Functions \ Response Section/ Agency	City of Chicago	IEPA	IDNR	Law Enforcement Agencies	MWRD	USACE	USCG	USEPA	USFWS	USDA-APHIS	Supporting Agencies**
Incident Management			●					○	○	○	
Operations	○	○	●	○	○	○	○	○	○	○	○
Sites (Selection, Activation, Setup, Management)			●		●						
Communications	○	○	●	○	○	○	○	○	○	○	○
Waterway Shutdown						○	●				
Lock and Dam Closure						●	○				
Site Staffing	○		●	○	○	○	○	○	○	○	○
EOC Staffing	○		●					○			
Liaison	○	○	○	○	○	○	○	●	○	○	○
Site Health and Safety		●	○								
Public Information and Media	○		●			○	○	○			
Site Security				●	●		●				
Resource Management	○	○	●	○	○	○	○	○	○	○	○
Science Advisory/Risk Analysis			○						●		
Offsite Environmental Impacts		○	○					○	●		
Cost/Time Tracking	○	○	●	○	○	○	○	○	○	○	○
Procurement	○	○	●	○	○	○	○	○	○	○	○

* Does not factor in weather or other unexpected event that may alter or add additional responsibilities to this rapid response.

** Supporting agencies include GLFC and multiple states fisheries management agencies and Canadian provinces.

EOC Emergency Operations Center

Legend: ○ = Support, Coordination, and Involvement ● = Primary Responsibility

2.2 PRIMARY RAPID RESPONSE PLANNING ORGANIZATIONS

Implementation of this plan at any of the three locations described in Section 1.2 or during the emergency scenario will depend on the cooperation of a broad variety of organizations and agencies, including, but not limited to, the agencies listed in this section and Section 2.3 below. This section describes federal, state, and local agencies/stakeholders that have legal authorities in conjunction with an AIS introduction specific to the target areas. Note: This section may be subject to revision pending additional information gathered from responding agencies.

2.2.1 Illinois Department of Natural Resources (IDNR)

According to the Department of Natural Resources Act (DNRA) (20 ILCS 801/1-15) "It shall be the duty of the Department to investigate practical problems, implement studies, conduct research and provide assistance, information and data relating to the technology and administration of the natural history, entomology, zoology, and botany of this State; the geology and natural resources of this State; the water and atmospheric resources of this State; and the archeological and cultural history of this State."

IDNR is the lead fisheries management agency within the state of Illinois; as such and in accordance with DNRA, IDNR will serve as lead responding agency in rapid response operations against Asian carp for the treatment of the waterways that fall under the scope of this plan utilizing all available personnel and equipment in these actions. Working in conjunction with the State of Illinois, the director of IDNR shall activate the Rapid Response Plan and established notification list.

2.2.1.1 Illinois DNR Office of Law Enforcement - Conservation Police

The Conservation Police are the law enforcement branch of the IDNR. As IDNR is serving as lead agency for rapid response operations, the Conservation Police will act as lead security agency for response activities onsite. They will be responsible for providing a Site Security Plan (Appendix D) and coordinating with other agencies to provide security for all personnel and assets onsite.

2.2.2 United States Coast Guard (USCG)

USCG delegation of public duties is found in Volume 33 of the *Code of Federal Regulations* section 3.01. Duties include (1) enforcement of port safety and security and of marine environment protection regulations within areas for which USCG is responsible, and (2) operations for protection and security of vessels and waterfront facilities in that waterway. The Captain of the Port shall be responsible for closing this waterway for its security, if necessary, during such operations.

2.2.2.1 USCG Sector Lake Michigan, Milwaukee

Based on its proximity to the area and vested interest in the Great Lakes, the USCG Sector Lake Michigan stationed in Milwaukee, Wisconsin, (USCG Milwaukee) would also assist in response operations based on the availability of resources at the time of response. USCG Milwaukee will provide trained personnel to the effort and assist as necessary. USCG Milwaukee has assets in the areas north and south of the barrier system that could actively patrol these waters. During times of response in this area, USCG Milwaukee may be able to utilize these resources to patrol these waters and maintain security and safety.

2.2.2.2 USCG Marine Safety Unit (MSU)

The USCG Marine Safety Unit Chicago is responsible for executing the USCG Port Safety and Security, Marine Environmental Protection, and Commercial Vessel Safety missions under the auspices of the Department of Homeland Security. The USCG MSU will serve in an advisory capacity to support USEPA during response operations.

2.2.3 Metropolitan Water Reclamation District of Greater Chicago

The Metropolitan Water Reclamation District of Greater Chicago (District) operates Publicly Owned Treatment Works (POTW) which treats wastewaters from domestic, commercial, and industrial sources in Chicago and numerous surrounding communities. The District's jurisdictional authority consists of ownership of land on both sides of the CSSC to its confluence with the Des Plaines River at RM 290.0. As such, access to any adjacent properties must be granted through the District.

2.2.4 United States Army Corps of Engineers (USACE)

The USACE has authority for all matters pertaining to the electric barrier system in place within the Lockport Pool of the CSSC, including operations, care, maintenance, and anything that may affect the system. It also has authority over the operation of the lock and dam system in place within the CSSC. During any rapid response operations, the USACE will be responsible for the closing of the Lockport Lock and Dam prior to a Rapid Response and the Brandon Road Lock and Dam if necessary. USACE will also monitor the barrier system before, during, and following rapid response to ensure sustained operations. USACE also serves on the Asian Carp Rapid Response Workgroup to advise on recommendations affecting response options.

2.2.5 United States Environmental Protection Agency (USEPA)

As a general rule under the National Environmental Policy Act (NEPA), federal agencies must consider the environmental impacts of "major federal actions significantly affecting the human environment" and identify unavoidable environmental impacts before implementing the proposed action. In compliance of NEPA, USEPA will prepare an Environmental Assessment (EA) to ensure protection of the environment particularly with a focus on endangered species. In addition, to comply with FIFRA USEPA will ensure that any registered piscicide used will be applied under established registration procedures, specifically section 24c of the Registration Eligibility Decision (RED).

The USEPA may provide additional personnel for response actions based on availability and time of response.

2.2.6 United States Fish and Wildlife Service (USFWS)

In working to protect native fish populations and important commercial and recreational fisheries, USFWS plans to support the planning and operations of a rapid response action by supplying in-kind assets such as personnel, equipment, other supplies, and technical expertise. USFWS will be listed as the agency with primary responsibility for the Science Advisory Team. USFWS designated personnel will also serve as part of the Incident Management Team. Fiscal resources may be offered to support rapid response actions if funding allows. Prior to plan initiation, USFWS will develop and implement MOUs or other Interagency

Agreements that fulfills the purpose of clearly defining the specific roles and responsibilities of each agency acting to support the Asian Carp Rapid Response Plan.

2.3 SUPPORTING RAPID RESPONSE PLANNING ORGANIZATIONS

The following organizations and agencies will support operations for an AIS rapid response as they have a vested interest in participating in such actions so as to protect the Great Lakes from introduction of Asian carp. A summary of intentions is presented below for each supporting organization or agency.

2.3.1 Great Lakes Fishery Commission (GLFC)

The GLFC has a long history of battling to control aquatic invasive species within the Great Lakes basin. Consistent with this tradition, the GLFC will offer trained personnel and emergency funding to rapid response operations. The GLFC will also lobby state and federal governments to garner support for operations, and request legislation for any long-term efforts aimed at controlling Asian carp and its expansion in the waters of the Great Lakes.

2.3.2 City of Chicago

To support the efforts to restrict Asian carp downstream of the electric barrier system, the City of Chicago will respond to any Asian carp operations in accordance with the City's Emergency Operations Plan (EOP)—each city department will conduct its responsibilities as designated in the EOP. The City also will apply resources and assets to support these efforts.

2.3.3 International Joint Commission (IJC)

Through the ongoing commitment of the IJC to protect all Boundary Waters between the U.S. and Canada, the IJC will support the rapid response actions to mitigate the threat of Asian carp to the Great Lakes. The IJC will offer support through participation in the response planning initiative and advocate for government support for the project if the circumstances merit these activities.

2.3.4 Midwest Generation, LLC

Midwest Generation will support the effort at Asian Carp control by monitoring its Will County station intake pipes for the presence of Asian Carp. They will adjust operation as needed to support response operations. Midwest Generation will remain in communication with IDNR and USEPA to report any new findings. Their operations are likely to be affected by any rapid response actions; as such they will be notified as soon as possible following a decision to implement a rapid response so that they may plan accordingly.

2.3.5 Affected Counties

Local law enforcement, county/local Offices of Emergency Management, Emergency Medical Services (EMS), fire departments, etc. should all be notified of pending operations within their jurisdictions so they may prepare for potential actions. Local law enforcement may be needed to support mission in their respective jurisdictions.

2.3.6 Other Support State and Provincial Agencies

Fisheries management agencies from the States of Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania, and Wisconsin will supply in-kind support as available and able in the form of personnel, equipment, chemicals, or financial contributions. Though these agencies have no authority within the proposed areas of action, they recognize the threat of the Asian carp expansion and strive to maintain the integrity of the Great Lakes.

Working to foster bi-national support for Asian carp control, Fisheries and Oceans Canada plans to support treatment of the CSSC and subsequent clean-up activities in Illinois by supplying in-kind support in the form of expertise, personnel, and equipment as available. Though they have no authority in the target area, their Aquatic Invasive Species Program is focused on prevention and keeping Asian carp out of the Great Lakes. The Ontario Ministry of Natural Resources, through their ongoing collaboration with Fisheries and Oceans Canada for AIS prevention in the Great Lakes, will be providing support for in-kind resources and assets to be used in conjunction with rapid response operations. Additionally the province of Quebec will provide fiscal resources to Illinois in support of a rapid response has funds are available.

2.4 CONCEPT OF OPERATIONS

- This Rapid Response Plan is consistent with preparation and response roles and responsibilities within the National Incident Management System (NIMS) Incident Command System (ICS).
- This Plan complies with appropriate federal, state, and local laws and authorities (see Appendices N and O, Glossary, Authorities, and References).
- Since the CSSC is an actively used waterway, stakeholder agencies including those that utilize the canal for commerce must be notified as soon as possible following the decision to implement a rapid response so that they may plan for interrupted operations as necessary.
- The Des Plaines River, I & M Canal, and CSSC Asian Carp Rapid Response Plan describes in detail the prescribed response actions for Asian carp within defined locations of the Illinois River, Des Plaines River, or CSSC. Aspects of the response are:
  - Planning
  - Activation
  - Staffing
  - Safety
  - Security
  - Control and/or disposal
  - Monitoring
- IDNR will direct operations of Asian Carp rapid response activities.
- When all or part of the plan is activated, each organization with an emergency responsibility or support intention will apply its resources to the operation under direction of the Incident Commander (IC) within a Unified Command as agreed upon through agreements prior to response operations.

2.4.1 Response Trigger

The Asian Carp Rapid Response Workgroup has deemed the following triggers will activate rapid response operations:

- Positive confirmation of Asian carp between Barrier II and Barrier I
- Barrier Maintenance
- Catastrophic failure of the electric barrier system assuming fish can be contained downstream of electric barrier system

2.4.2 Rapid Response Operations

Implementation of this Rapid Response Plan consists of four phases: preparedness, response, recovery, and mitigation (see section 5.0 for mitigation actions). Specific operational procedures will be dependant upon the treatment selected at the time of Plan initiation. Information on chemical application procedures can be found in Appendix G of this document.

2.4.2.1 Preparedness Phase

This phase shall begin well in advance of implementing operations in response to the threat of Asian carp expansion into upstream location of the Des Plaines River, CSSC, or I & M Canal. It signals the threat is imminent and shall conclude when the actual response is triggered. This phase includes planning functions necessary to carry out a rapid response and includes the following:

- Selection of a rapid response planning team from IDNR and partner agencies or organizations
- Review of current legislation regarding AIS authorities and proposed treatment options
- Request of information, support, and resources from stakeholder representatives to implement a rapid response
- Assurance that agreements are in place for efficient operations
- Site selection for treatment and staging
- Selection of potential treatments best suited for each location.

2.4.2.2 Response Phase

This phase, Rapid Response Operations Phase, will be initiated by the pre-established triggers, and will extend into the process of follow-up monitoring. The following functions occur within this phase:

- Plan initiation
- Treatment selection
- Stakeholder notification
- Mobilization
- Treatment Application

- Detoxification if necessary
- Initial follow-up monitoring of area for Asian carp utilizing electrofishing, netting, eDNA analysis, and/or sentinel fish.

2.4.2.3 Recovery Phase

The Post-Response (Recovery) Phase begins with conclusion of water treatment and/or termination of the threat of Asian carp within the treatment area. This phase may begin during follow-up monitoring activities, which may continue well into recovery efforts. This phase ends with the After-Action Report (AAR) and dissemination of lessons learned. Components of the Recovery Phase are as follows:

- Continued follow-up monitoring efforts
- Cleanup and disposal of all recovered fish and bio-mass from the treatment area
- Demobilization
- Determination of capture and document costs
- Preparation of an AAR
- Preparation for future rapid response based on AAR, lessons learned, and continued training and exercises.

2.4.3 Other Control Actions

Other actions may be necessary in conjunction with a rapid response operation to ensure control and halt of the spread of Asian Carp. These actions may include but are not limited to the following:

- Seine/block netting during operations to further isolate treatment area
- Closing of locks where possible to prevent escape of fish during treatment
- Increased electrofishing or netting during canal treatments or shutdown of electric barriers for maintenance
- Sentinel monitoring to ensure treatment efficacy.

2.4.4 Reverse Trigger

One or all of the following may signal conclusion of response activities, depending on response actions implemented:

- Completed detoxification of treatment area
- Conclusion of cleanup actions
- Maximum dose achieved
- Dose timeline complete
- Negative result of sentinel monitoring within the treatment area for Asian carp
- Catastrophic event within treatment area.

2.5 COORDINATING INSTRUCTIONS

This section presents the roles and important event specific information necessary for carrying out safe, efficient, and effective operations.

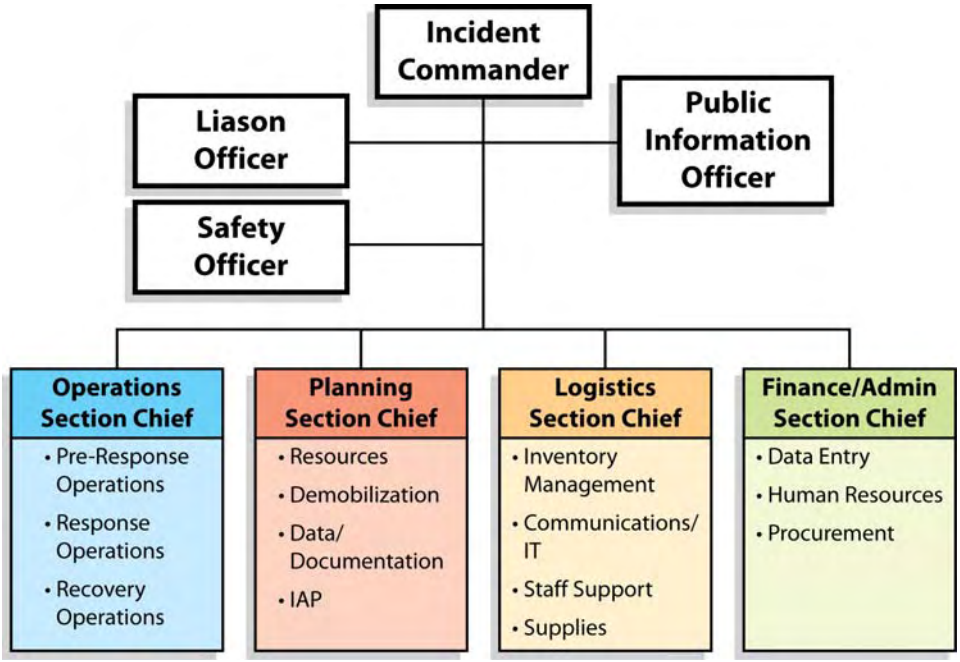
2.5.1 Incident Command System (ICS)

Under the direction of HSPD-5, the Federal Government has adopted the NIMS to manage emergency incidents and disasters from the first responder level to the highest levels of the Federal Government. It is based on the Incident Command System (ICS) and the Unified Command System (UCS), and is flexible and appropriate to all types of incidents. ICS will be used both on-scene by response staff and in the Emergency Operations Center (EOC). Unified and/or Area Command will be instituted when multiple agencies have jurisdictions over locations or actions occurring through rapid response operations, or when the geographic area of the operation is so large that a single operation is not feasible. The lead jurisdictional authority is responsible for activation and implementation of the command structure necessary to respond to and support efforts for containment and control of an Asian carp introduction. Because stakeholder agencies do not utilize a synchronized organizational structure for daily operations, the Asian Carp Rapid Response Plan will utilize ICS to effectively organize both staffing and responsibilities upon plan activation.

Within ICS and this rapid response, sections, branches, groups, units, and teams will be activated and staffed as necessary to adequately respond to the incident.

The ICS is flexible and may be expanded, contracted, or combined with different branches, groups, units, or teams as required by the incident. The following organization chart exemplifies the ICS structure and includes the main duties that will be relevant to this rapid response:

General ICS Command Structure Organization



2.5.2 Interagency Coordination (See Annexes 1 and 2)

2.5.3 Key Points of Contact

An important element of any response is the capability to contact personnel and to mobilize resources. Appendix E contains contact information regarding all stakeholder agencies and partner resources within the vicinity of treatment, as well as regional, state, and federal agencies.

2.5.4 Rapid Response Plan Activation

To ensure effective coordination upon RRP activation, the following key points should be in place and pre-planned.

2.5.4.1 Roles and Responsibilities

This section lists official roles and responsibilities of personnel active in the Rapid Response Plan.

Incident Commander (IC)

The IC is responsible for directing and coordinating activities of the rapid response. This person(s) will manage and control the total operation of the response. The IC ensures that staff and supplies are applied so that the response proceeds at the highest level of efficiency. The IC directly oversees operations, logistics, planning, and administration by working closely with the section chiefs and coordinators for all shifts.

Information Officer(s)

The Liaison Officer (LOFR) establishes and maintains a relationship with all stakeholders to provide and receive information to/from the IC and Public Information Officers (PIO). The rapid response PIO coordinates media activities and information releases with the EOC PIO for release. Media communications are the responsibility of the EOC PIO. Information is forwarded to the PIOs for possible distribution to appropriate groups or organizations. The PIO participates in the pre-established Joint Information Center (JIC) / Joint Information System (JIS).

In cooperation and coordination with other spokespeople at the JIC (public officials, health officers, emergency management personnel, etc.), PIOs must understand what events, progress, and incremental steps should trigger release of public information as the event unfolds. No information is released without prior approval from the IC.

PIOs should have knowledge about the following:

- What to release (type of information)
- When to release it (timing)
- How to release it (press events, press releases, phone calls, etc.)
- Where to release it (at JIC location, on-scene, etc.)

- To whom to release it (press, directly to local organizations)
- Who will release it (JIC PIO, county official, other designated spokespeople).

Health and Safety Officer (HSO)

The HSO's primary responsibility is to write the Health and Safety Plan. The HSO is responsible for overseeing and ensuring that response activities are free from health and safety hazards before, during, and after operations through use of ICS form(s) 215, 215A, 215A-ORM. The HSO also collaborates with the other Section Chiefs regarding resolutions of any safety issues.

Operations Section Chief

The Operations Section Chief is responsible for all the operational activities of the response. The Operations Section has responsibilities within the following functional areas:

- Containment
- Treatment Application
- Cleanup
- Disposal
- Short-term Monitoring.

The Operations Section Chief ensures that staff in the respective areas fulfill requirements of the standard operating procedures (SOP) and remain within their respective scopes of practice and training. If staffing adjustments are needed, this Chief develops the plan and provides recommendations for the IC to consider and/or implement in coordination with the Planning Section Chief and the HSO.

Planning Section Chief

The Planning Section Chief is responsible for providing all planning services for the response within the following functional areas:

- Resource Tracking
- Demobilization
- Environmental Unit
- Situational Awareness
- Documentation/Data Surveillance (geographic information system [GIS] data).

This includes collection, evaluation, and dissemination of situational and resource status information. This Chief develops the approved Incident Action Plan (IAP), conducts formal briefings at the start of each operational period, obtains and develops maps or diagrams of the response area, maintains a field activity log, and prepares a demobilization plan.

Logistics Section Chief

The Logistic Section Chief is responsible for all support needs of the response. The Logistics Section consists of the following functional areas:

- Security
- Receipt, handling, and management of supplies
- Food/sanitation/medical services (for responders)
- Equipment maintenance
- Communications
- Personnel and assets check-in/check-out
- ID badging if necessary
- Per diem arrangements to be made for supporting agencies' personnel
- Emergency contact lists.

The Logistics Section is tasked with management of all response logistics and requests for additional supplies; therefore, this Chief must work closely with the Operations Section Chief and the IC. The nutritional needs of the staff are essential, and satisfaction of this must be coordinated with the EOC and other agencies as necessary.

Communications Unit

The Communications Unit reports to the Logistics Chief and is responsible for coordinating internal and external communication resources such as radios, walkie-talkies, land and cell phones, computers, printers, and fax machines. Telecommunications and information technology are crucial because incoming and outgoing information must be efficiently and consistently communicated. Important specifications such as number of radios, frequencies used, and who has what type of equipment must be determined prior to a response. The Communications Unit Leader performs an inventory analysis at the end of each shift to account for such materiel. All administrative areas must have, at minimum, phone lines. The Communications section must have dedicated phone lines and computers to receive and transmit requests and information. The Communications Unit Leader and section coordinators must provide technical assistance, as needed, or be able to access such assistance. The Communications Unit Leader may consider a staff pool designated to respond if resources are scarce, inadequate, or inoperable.

Administration/Finance Section Chief

The Administration/Finance Section Chief is responsible for ensuring all personnel, volunteer, and supply records are correctly recorded and maintained throughout the event. This section is activated only when involved agencies have financial services needs. The Administrative and Finance section has responsibilities within the following functional areas:

- Coordination of personnel/volunteers (time records, credential verification, staff schedules)
- Communication with the Section Leads, IC, and EOC regarding problems, shortages, needs, etc.
- Procurement Resources/Assets

Time, procurement, and cost accounting are the primary functional activities of this section. This section manages all paperwork resulting from a response. This section is responsible for permitting issues and forms pertaining to treatment applications, and for communication of changes in standing orders.

This section must ensure that any mutual aid agreements initiated during the response are properly documented. Additionally, this section directs management of unassigned personnel/staff, such as spontaneous volunteers who may report on site and coordinate with the HSO to document injuries that may require worker's compensation claims.

2.5.5 Treatment Selection

Once the decision is reached to activate the rapid response the treatment must be selected based on the any of the following parameters:

- Location of Asian carp that triggered response
- Treatment efficacy
- Human and ecological safety concerns
- Current regulations pertaining to waterway treatment
- Current weather conditions that may affect treatment.

Refer to appendix F for the Treatment Selection Matrix and corresponding selection elimination criteria.

2.5.6 Site Safety and Security

On-site safety and security involves the following procedures and physical measures to prevent interruption of response operations:

- Preventing unauthorized access to locations at which support response operations are occurring
- Facilitating application of treatment via appropriate resources and personnel
- Controlling crowds that might interfere with effective response operations
- Protecting personnel, equipment, and assets of the response from injury, theft, damage, or destruction.

The IC is ultimately responsible for response safety and security, and designates an HSO and alternate to oversee this function. The HSO, or designee, will be on site any time response actions are occurring, 24/7. Security personnel stationed on site are clearly identified and visibly positioned throughout the site.

Developing the Rapid Response Health and Safety Plan (HASP) is the responsibility of the designated HSO and safety staff. The HASP for all rapid response operations can be found in Appendix C of this document. The rules and guidelines in place now will be used to mitigate safety onsite during response operation.

As lead security agency, the Illinois Conservation Police will develop a security plan for on-site operations (Appendix D). This will include perimeter security, internal staff and waterway patrol, and boat operator credentialing. Security resources may include, but are not limited to, Conservation Police, USCG, municipal police, state police, sheriffs, constables, private security firms, and other mutual aid partners.

2.5.6.1 Rapid Response Safety Guidelines

Activation and operation of the Rapid Response is an urgent deployment of personnel to quickly and efficiently apply specified treatment to the designated site along the waterways cited above. This operation requires efficiency, and safety must be a top priority. This section describes the aspects of safety during response operations.

2.5.6.2 Safety Briefing

Before beginning any duties, all personnel must receive a safety briefing from the HSO. This safety meeting should be brief but clearly explain the unique hazards within response operations.

2.5.6.3 Hazards

Response operations have many unique hazards that can be mitigated by following established facility safety rules, being alert at all times, and making safety a top priority. Personnel assigned to on-site operations must know their limitations and only complete tasks for which they are trained and physically capable of undertaking safely. Everyone must be on constant lookout for hazards and potential safety challenges. If any hazard is observed, immediately advise the HSO and others and take necessary steps to mitigate the danger.

Electric Barrier System

An electric barrier system is in place within the Lockport Pool of the CSSC. Barrier IIA currently sends two volts/inch of electricity through the water to deter fish from passing through. Physical contact with the water in this area is likely to result in serious injury or death. This poses a threat to all boats and people passing through this area. To ensure safety in the proximity to this barrier a Restricted Navigation Area (RNA) has been established and strictly enforced by the USCG. The RNA runs from approximately RM 296.7 at the aerial pipeline downstream to RM 295. Current regulations state that the RNA shall remain closed to the following types of vessels:

- All vessels under 20 feet in length
- All personal watercraft
- All non-power driven vessels.

For the safety of this response, any operations requiring actions within this area of water must comply with direction from the Coast Guard's on-scene representative and include the following measures:

- Wear Coast Guard approved Personal Flotation Device (PFD)
- Avoid contact with standing water
- Avoid contact with anything outside the hull of the vessel
- Allow disabled vessels to float free downstream of RNA without paddling.

Boating Safety

Each boat deployed to the project area should be operated by a trained individual. Each person on board will wear Coast Guard Approved Personal Floatation Devices (PFDs) and a well-supplied first aid kit to handle minor injuries, scrapes, cuts, etc. will be onboard. See previous section for additional safety precautions regarding boat operations within the electric barrier system's RNA. Additional specific requirements will be included within the Incident Action Plan (IAP).

Heat/Cold Stress

Heat stress is a significant concern where moisture-impervious clothing is required, especially during warm months. Employees wearing protective equipment will be instructed to drink plenty of fluids and take work breaks regularly and whenever necessary. Anyone suspected of suffering from heat stress should seek immediate medical attention and the site safety official notified.

Hypothermia is a significant concern in cold-weather months, and is aggravated by water exposure and windy conditions. Special precautions will be taken should this plan be implemented in cool weather. More personnel will be required so that employees can rotate out of the work zone to a heated location to warm up. It is recommended that all steps possible be taken to eliminate the need for treating this water during cold weather. However, should this prove necessary, cold-weather protective gear including coveralls, boots, gloves, and hats will be required for all personnel. Additional protective requirements for all personnel will be outlined in the HASP.

Icy Conditions

Should this implementation of response operations occur during cold weather or winter months, ice buildup along the banks, along access roads, throughout staging areas, and on boat decks will be a hazard. Additional precautions may be necessary to ensure the safety of on-site personnel. It is recommended that all steps possible be taken to eliminate the need for treating this water during cold weather. However, should this prove necessary, sand, road salt, or ice melting measures will be needed.

Spill Containment

Any spill occurring prior to application (i.e., during material delivery and transport) will be immediately reported to the IC, HSO, and Security Supervisor to receive cleanup instructions. To minimize potential damage caused by spills, all mixing of piscicide will be conducted on boats or at a mixing station within the application area. Pesticide containers will be opened only when they are needed and ready to be mixed and applied. A certified Aquatic Pesticide Applicator will direct mixing and application of concentrated product. Each employee involved will be required to become familiar with the use labels, material safety data sheets (MSDS), the Site Safety plan, and the Spill Containment plan.

In event of a spill, immediate containment will be the task of highest priority. All personnel necessary to control the spill should deploy immediately to the affected area. If the spill is significant (>10 gallons of liquid or 50 pounds [lbs] of powder), responders will notify the IC who in turn will notify the National Response Center (NRC), HSO, and Security Supervisor immediately and follow the procedures below. The report needs to be in accordance with 40 CFR 300.

For minor spills (<10 gallons or 50 lbs.), notification to the IC and HSO can take place at the earliest convenience. Minor spills of pesticide onboard boats shall be diluted with water and added to the treatment

area by use of a mechanical pump. Shovels, brooms, dust pans, diking materials, and containers will be available at the loading and mixing areas to assist in control and cleanup of any spilled materials on land. A spill of pesticide on the ground will be recovered and used in the application if possible. For spills on the ground, the following actions will be taken as necessary:

1. Stop the release at the source.
2. Dike the material into pools or channel into the treatment zone.
3. Recover liquid by use of mechanical pump or sponge and add to mixing container.
4. Absorb the remaining pesticide into the chemical absorbent material provided.
5. Sweep up the absorbent and place in sealed plastic disposal drum.
6. Sweep up the neutralizing agent and deposit in a sealed plastic drum.

Materials and equipment in contact with piscicide will be washed in an area adjacent to the treatment zone in a manner which causes all rinsate to flow into project waters.

2.5.6.4 Staging and Treatment Areas

The staging areas located on site house all equipment for operations. Greater movement of heavy equipment, personnel, and/or chemicals throughout this area increases potential for injury.

To ensure safety on site, the following precautions are necessary:

- Only necessary and authorized personnel shall gain entrance to these areas.
- Only trained or licensed personnel shall operate equipment and apply treatment to designated areas under the provisions of the Federal Insecticide, Fungicide, and Rodenticide Act, (FIFRA) (7 USC 135 et.seq.).
- All paperwork for resource and assets tracking shall occur outside of high-traffic areas.
- Adequate personal protective equipment (PPE) must be worn in each of these areas during all phases of operations.
- Equipment not in use must be properly secured.
- Safety staff shall conduct tailgate safety meeting every operational period or shift and assess response operations and make recommendations to IC if necessary to improve overall safety.

2.5.6.5 Response Security

To ensure safety and security of the rapid response operations and on-site assets, security staff should consider and implement the following protocols:

- Monitor and control all access points.
- Create and use staff roster for entry and exit of personnel.
- Monitor response operations.
- Direct approved members of the media to pre-designated gathering areas for any press releases.

The following checklist can be used as a general guide for security areas and responsibilities, but should be tailored to each response and location.

RAPID RESPONSE SECURITY CHECKLIST

- ☐ Site map/layout including waterways, treatment areas, and staging areas
- ☐ Secured access and entry points
  - How many access points to onshore operations areas?'
- ☐ Control measures in place at all points of entry
- ☐ Waterway secured for operations
- ☐ Parking area in place and secured for response personnel
- ☐ Chemical stockpiles for treatment segregated from other supplies and secured at all times
- ☐ All equipment and resources secured at all times, including when response operations are not occurring
- ☐ Adequate lighting on site to ensure safety and security
- ☐ Staging area segregated from general operations on site
- ☐ Any additional roads that lead to the site secured
- ☐ Interoperable communications among all security agencies and departments established
  - Radio frequency specified
  - Alternate modes of communications available
- ☐ Response personnel identified and/or badges in use for ease in identification
  - If normal business functions also occur on site and additional personnel are present, they are to be identified by roster or badges for safety and security

3.0 ADMINISTRATION AND LOGISTICS

3.1 ADMINISTRATION

3.1.1 Concept of Support

Rapid Response operations depend on timely arrival of resources and assets from partner agencies and commercial vendors to the pre-established staging area. In preparation for events, agency-available asset listings shall have been compiled so that additional support equipment can be ordered well in advance of operations in order not to hinder progress. Additionally, chemical and supply vendors shall be contacted to estimate delivery time of essential resources. (See Appendix B for resources and assets available for response activities.)

3.1.2 Cost Capturing and Funding

Thorough and complete documentation with explanations and/or justification is necessary. Regardless of the type of financial assistance sought, organizations should, at a minimum:

- Implement a records management and retention program for each project.
- Maintain accurate disbursement and accounting records.
- Establish invoice approval process.

For the purposes of this Asian Carp Rapid Response IDNR will implement the following in addition to the above:

- Establish a programmatic code define as "All activities related to preventing range expansion of Asian carp"
  - This has been defined by IDNR's Office of Resource Conservation (ORC) as a Wildlife and Fish licensed revenue eligible programmatic code
  - IDNR employees should utilize this code when completing their programmatic time sheets
  - Vouchers for non-personal service costs such as chemicals, contractual expenditures, travel, commodities, etc., will also utilize this code
- Develop a blended rate for all in-kind donations of commodities and labor from all other organizations for cost capturing.

3.1.3 Legal Considerations

Any rapid response operations taking place within the Lockport Pool of the CSSC will require waterway shutdown and lock closure for an extended period of time, depending on treatment used. Closure of Lockport Lock must be approved and carried out by USACE in advance of operations. Closure of the waterway must be approved and carried out by the USCG. IDNR Office of Law Enforcement will work closely with the USCG to ensure a closed and secure waterway for the duration of operations. Note: This section is subject to revision pending additional information.

4.0 COMMUNICATIONS

4.1 UNIFIED COMMAND

The IC determines the most effective communications on scene or prior to operations, based upon response and/or site conditions. Necessary personnel will be contacted via the notification contact list (Appendix E). Communications between agencies and the public shall occur through a designated PIO. See Section 4.2.2 for further information of the role of the PIO.

4.1.1 Joint Information Center (JIC)

A JIC may be set up at any time after initiation of the event, once it becomes apparent that multiple agencies will be engaged in response activities and ongoing public communication will be necessary.

The JIC is a physical or virtual location where public affairs officers from participating agencies come together to ensure coordination and release of accurate and consistent information that is disseminated quickly to the media and the public. The JIC may be established at the headquarters of IDNR or in a local jurisdiction, depending on the geographic scope of response. It is generally helpful to locate the JIC as close as possible to the command post.

Representatives to the JIC may include agency stakeholders' public information officers, liaison officers, and necessary advisors. If convening at the JIC is not feasible, all organizations are encouraged to conduct their information activities in cooperation with the JIC. Once a JIC is established, authorities must identify a lead public health spokesperson to participate in the JIC and to serve as a liaison with the health department, as well as assure the JIC is staffed during all operational hours (potentially 24 hours per day).

4.1.2 Federal, State, County, and Local Operation Centers

Emergency management coordinators are the lead agents for public preparation, response, and recovery efforts. These efforts are coordinated at EOCs.

4.1.3 Communications Capabilities

It is extremely important for constant communications in the field; a breakdown at any point in the chain of command could disrupt or halt response actions entirely. Therefore onsite communications will primarily rely on cell phone usage with 2-way radios on hand and ready. Command staff, general staff, and branch chiefs will have both forms of communications.

4.1.4 Communications Procedures

- The use of acronyms and bureaucratic jargon make effective private-sector engagement in discussions on preparedness, response, and recovery difficult. Clear and open communication between the public and private sectors is essential for effective planning and for accelerated recovery.
- To enhance communication, provide a toll-free number(s), conference bridge number(s), e-mail address(es), and central news source(s) for obtaining situational awareness before, during, and after a disruption.

- Coordinate and implement best business practices for public and private-sector dialogue.
- Prior to a Rapid Response, IDNR should prepare the following for use during operations:
  - Prepare pre-scripted fact sheets and public information/education for treatment applications that may be utilized.
  - Prepare pre-scripted water orders for the treatment area and any potentially affected areas downstream or adjacent to the waterway.
  - Contact local news media to provide information on the Asian carp rapid response and to prepare a media plan.

4.1.5 Alert and Notification

Upon decision to act and initiation of response, all personnel, agencies, sponsors, and interested parties will be notified of rapid response actions according to the following notification list. Each person listed must make a personal call and speak directly with every individual (or his/her designee) whom it is their responsibility to notify. Contact numbers are also included in Appendix E.

TABLE 1. RESPONSE OPERATIONS CALL-DOWN LIST

Succession Order	Name	Agency	Phone Number
Primary			
Alternate 1:			
Alternate 2:			
Logistics Lead			
Operations Lead			
Planning Section Chief			
Administration			
Security			
Health and Safety			
Other			

4.2 SIGNAL

This rapid response will entail both administrative report and public information reports to be generated. These must flow along the proper chain of command and proper communication will be required for completion.

4.2.1 Administrative Reports

Submit reports as required by individual organizations and as specified by the UC, when established.

4.2.2 Public information

Public communication before, during, and after an event informs and reassures the affected population and the essential workforce. Employing strategic communications concepts, such as specific, pre-scripted, unified messages and information themes—and methods of their dissemination—is recommended. These strategic concepts should be coordinated through the PIO and agency liaisons with the UC / Emergency Operations Centers and local media outlets, and exercised with collaborative stakeholders.

4.2.3 Interoperable Communications Assets

Operational success depends upon available and interoperable communication systems that provide:

- Ability to communicate within the ICS
- Ability to communicate with business contingency staffs and affected elements
- Ability to communicate with external agencies, especially critical recovery assets
- Access to critical data and systems necessary to conduct essential functions.

4.2.4 Interoperable Communications Systems Worksheet

The Interoperable Communications Systems Worksheet should be used during exercise scenarios by planners/managers to document communications interoperability gaps for subsequent exercise improvements and real world event planning. The following table is an example of communications that may be available during a response. This worksheet should be filled out in advance of operations.

Service	Provider	Specifications	Alternative Provider	Special Notes
Voice lines				
Fax lines				
Data lines				
Cellular phones				
E-mail				
Internet				
Web Portal				
PDA Wireless				
Text Messaging				
Instant Messenger				

5.0 FUTURE MITIGATION

In conjunction with rapid response actions, the Asian Carp Rapid Response Workgroup recommends, with support from stakeholder agencies, additional measures be investigated and implemented in or near the areas of concern to further mitigate the threat of Asian Carp expansion and reduce propagule pressure within this system. These measures include further investigation and placement of one or several hybrid Sound Projector Array driven BioAcoustic Fish Fence systems and further investigation with interim measures into areas of the Des Plaines River and the I & M Canal where there are interconnectivity concerns with the CSSC. Rapid Response measures would be futile if longer term controls are not implemented. These measures are imperative to further control the expansion of Asian carp upstream toward the Great Lakes, and increase the long-term efficacy of any rapid response actions taken.

5.1 SOUND PROJECTOR ARRAY DRIVEN BIOACOUSTIC FISH FENCE SYSTEM

The Sound Projector Array driven BioAcoustic Fish Fence system (SPA-driven BAFF) is used as a deterrent system for fish. The system employs an air bubble curtain that contains a sound field which, when set at a particular frequency range for specific fish, emits a sound unpleasant enough for the fish so as to deter them from proceeding beyond the barrier. Each component of the system acts as negative stimulus to the fish, working in conjunction with the other components to more effectively deter the fish. A strobe light can also be added to further enhance use of the system. Efficiency of the system varies, but significantly increases through fine-tuning of the frequency to target Asian carp, and further increases when fish are presented with an alternate means of travel away from the SPA-driven BAFF so that they do not continue to challenge the system.

The workgroup specifically recommends feasibility investigations at the current electric barrier system (at or near RM 296.0) and also just upstream of the confluence with the I & M Canal (at or near RM 289.0). These locations were chosen for the following reasons:

- Further fortification of the electric barrier may improve its efficiency and create additional obstacles for fish to cross. These barriers may work together to halt all species of Asian carp at each stage of development beyond unhatched eggs.
- Placement at RM 289.0 is considered optimal, as it is downstream of the confluence of the CSSC and the Des Plaines River. This may work to reduce continued expansion of Asian Carp into both of these waterways and reduce propagule pressure upstream.
- Placement of the system at this location would also allow fish an alternate route to swim upstream in to the I & M canal, as this location is upstream of its confluence with the Des Plaines River.
- The I & M canal is a discontinuous waterway, and assuming blockage of all routes into the CSSC, this would allow Asian carp to be herded and controlled by conventional capture method in and along the I & M Canal.

5.2 INTERCONNECTIVITY TO THE CSSC

The following sections address the issue of overland connectivity or culverts into the CSSC. Within both the Des Plaines River and the I & M Canal there exists areas that under certain conditions have the potential to flood to an extent that would provide flow into the CSSC and provide a means by which fish could swim from these waterways into the CSSC. These areas are also located upstream of the current electric barrier system; which if fish were able to cross these areas into the CSSC would have an unobstructed path into the Great Lakes.

5.2.1 I & M Canal

The Illinois & Michigan (I & M) Canal is a now-abandoned, man-made canal that once served to connect Lake Michigan to the Mississippi River Basin. The canal opened in 1848 and allowed for increased transportation to and from the Chicago area. Its use declined with construction of the CSSC, and all transportation operations ceased in 1933. The now-abandoned canal and the surrounding areas are used for recreational purposes (Canal Corridor Association, 2009). When its use as a transportation corridor was no longer needed, regular maintenance also ceased. Today it is a discontinuous waterway, and no more than a ditch in some areas. Though this canal is a man-made waterway with straight alignment, vertical walls, and bedrock bottom, much of it now resembles a natural stream or ditch because of lack of regular upkeep and maintenance.

The area of focus begins at the canal's confluence with the Brandon Road Pool of the upper Illinois Waterway, including Deep Run Creek, and ends before its confluence with the Cal-Sag Channel. A portion of the canal runs parallel with the CSSC. Along this stretch of canal are several culverts and one ditch that are used for drainage of the area during flooding, directing flow into the CSSC; several of these are upstream of the electric barrier in the CSSC. These culverts are in areas where the canal is restricted to drains that run underneath roadways. These restrictions of the waterway may flood during periods of high water, and because these areas are also very close to the CSSC, may create spillage into it—providing a path for Asian carp to swim into the CSSC. Hydrology data suggest that a 20-year flood could inundate this whole stretch, creating many areas for Asian carp and other fish to escape into the CSSC.

Deep Run Creek is a small, shallow waterway that connects the I & M Canal to the CSSC just upstream of its main confluence. This could pose a problem despite additional measures such as the proposed SPA-driven BAFF acoustic barrier to keep fish from progressing upstream farther in the upper Illinois Waterway. Deep Run Creek could allow the Asian carp a means to re-enter the Illinois Waterway upstream of the potential SPA-BAFF and increasing propagule pressure at the LL&D, and enter the Des Plaines River.

5.2.1.1 Current Status

As of October 2009, eDNA sample analysis indicated the presence of silver and bighead carp within the 10-mile stretch of the I & M Canal after its confluence with the Des Plaines River. The positive eDNA result was just upstream of the confluence, and nothing impedes progression of the silver carp further upstream. As of this time, no samples have been collected and analyzed from Deep Run Creek, which connects into the I & M Canal.

One further potential complication merits attention: previous hydrologic data indicates that flooding in this area could submerge certain lands and culverts between the I & M Canal and the CSSC, thus creating a by-pass through which Asian carp and other fish could flow with the current into the CSSC above the barrier and gain a clear path into Lake Michigan.

5.2.1.2 Recommended Mitigation Efforts

Recommend efforts within this area of the I & M Canal consist of the following:

- Perform new hydrology studies in the area as previous data is over 20 years old
- Institute flood control measures to ensure waters from the I & M canal are not allowed to flow into the CSSC
- Diversion of culverts and ditches that allow water to flow into the CSSC above the electric barrier system
- The Asian Carp Response Committee recommended closure of the I & M in two locations to prevent upstream movement of Asian carp from both the mouth of the I & M and Deep Run Creek.

5.2.2 Des Plaines River

The section of the Des Plaines River under consideration for treatment runs roughly from RM 297, just upstream of Romeo Rd., to RM 302.5. This section of the river consists of several backwater and wetland areas that may be accessible to Asian carp and other fish during periods of high water, and subsequently trapped here as the river recedes. These areas (see Figure 3 for exact locations) are considered optimal habitat for Asian carp. The river is considered navigable and mostly channelized. It was channelized because diversion of this section of river was necessary for proper placement of the CSSC; much of the river has a flat bedrock bottom and vertical limestone sides. This area of river is generally shallow, ranging in depth from less than 1 foot to about 4 feet, and can be walked across in several locations. The stretch of river running parallel to the CSSC is less than 100 yards away in some locations, and during periods of heavy rainfall, flood waters can run into the CSSC above the barrier system—potentially creating a means for Asian carp to evade the electric barrier system. A series of sluice gates control the water level in the CSSC by diverting water into the Des Plaines River at Isle a la Cache (RM 293.2), increasing the river's flow when the diversion gates are open. At this location, the river also begins its 20-foot drop to the level of the Ship and Sanitary Canal. The river and the canal join south of the Lockport Lock.

5.2.2.1 Current Status

As of September, 2009, eDNA sample analysis indicated the presence of silver carp within the 10-mile stretch of the Des Plaines River after its confluence with the CSSC. The positive eDNA result was at least 5 miles upstream of where the electric barriers are located in the CSSC. Historical observations of the expansion of Asian carp have shown that bighead carp tend to precede or travel concurrently with silver carp.

One further potential complication merits attention: hydrologic data indicate that flooding in this area could submerge certain lands between the Des Plaines River and the CSSC estimated at over 5 miles at this time, creating a bridge by which Asian carp and other fish could swim within the current into the CSSC above the barrier and have a clear path into Lake Michigan.

5.2.2.2 Recommended Mitigation Efforts

Recommend efforts within this area of the I & M Canal consist of the following:

- Further delineation of areas potentially susceptible to flooding into the CSSC through updating previous hydrology data
- Instituting interim flood control measures such as jersey barrier construction at highest point between the two waterways to ensure waters from the Des Plaines River are not allowed to flow into the CSSC
- Investigation and implementation of long-term separation of the two waterways.

6.0 EXERCISE AND TRAINING

6.1 TRAINING

Training is essential to familiarizing all personnel with their respective response/recovery functions and coordinating procedures. Stakeholder agencies and partner entities will benefit from training performed in the area of Asian carp control because a response of this kind on this scale is rare, and an aggressive approach to the situation.

6.1.1 Key Training Objectives

The following objectives should be met as a result of training activities in preparation for Asian carp Rapid Response Activities:

- Inform stakeholder and partner entities about the Asian Carp Rapid Response Plan, NIMS, and ICS response framework.
- Familiarize responders with operations and safety procedures to reduce the risks inherent to this type of response.
- Inform each responding agency or entity of its responsibilities, and familiarize it with operation hazards and concerns.
- Inform impacted property owners on potential events and outcomes.

6.1.2 Goals

The following goals should be considered throughout the training process:

- Inclusion of all stakeholder agencies and impacted property owners along the waterway in the planning, response, and recovery process—including integration into ICS command and information sharing
- Education on relevant federal and state regulatory requirements the groups just cited will be expected to understand and follow during operations
- Knowledge of resources at all levels available to assist in efficient completion of response operations and timely resumption of normal waterway operations.

6.2 EXERCISE

Regular exercise of the plan will increase efficiency of operations testing, identify operational gaps, and identify additional essential personnel and/or stakeholders necessary for operational success. Exercising regularly also aids in the plan amendment process because AARs may identify more efficient procedures and gaps that must be addressed.

Exercises include the following:

- A tabletop exercise validates the planning process through simulated scenarios played out through facilitated group discussion.
- Drills utilizing equipment and personnel test coordination and equipment systems to be used during response operations.
- A full-scale field training exercise complete with deployment of personnel and use of equipment tests operational efficiency and identifies areas for improvement.

Exercises should address the following:

- Effective information sharing
- Priority validation
- Evaluation of response and recovery procedures
- Roles, responsibilities, and organizational structure validation.

Annex 1

Lockport Pool to RM 296.7 Rapid Response Operations

ANNEX 1: LOCKPORT POOL TO RM 296.7 RAPID RESPONSE OPERATIONS

This Annex provides a plan to carry out Rapid Response operations for Asian carp control within the Lockport Pool of the Chicago Sanitary and Ship Canal (CSSC).

1. SITUATION

a. General:

1. Lead Department:: Illinois Department of Natural Resources (IDNR)
2. Background: Refer to Asian Carp Rapid Response Plan Section 1.4
3. Site Description:

The portion of the Lockport Pool from the Lockport Lock and Dam (LL&D), RM 291.1 to RM 296.7 is being considered for treatment (see Figure 1). This area is comprised solely of the CSSC and the land along its banks, and includes both industrial leases and vacant, undeveloped forest preserves.

The canal in this area is a man-made, industrialized waterway consisting of two-thirds treated wastewater through an excavated channel dug into limestone bedrock during the late 1800s. This area is used primarily for industrial shipping, with the exception of occasional passing recreational boats, and has no public access. The channel has a straight alignment and a rectangular cross-section of 160 feet wide and 23 feet deep. Between the LL&D and RM 293.5, the channel wall is vertical concrete on the east bank and varies on the west bank from vertical concrete walls to sloped sides reinforced by rip-rap. This implies uniform conditions along much of the treatment zone. The pool widens and shallows at two areas along the treatment zone.

Distinguishing characteristics along or within Lockport Pool to the RM 296.7:

- Lockport Powerhouse (MWRD), RM 291.1
- Lockport 9th Street Bridge, RM 292.7
- Barge repair facility, RM 295.3
- Midwest Generation, Will County Generating Station, RM 295.75
- East Romeo Bridge, RM 296.2
- USACE Electric Barrier System, RM 296.25
- Aerial pipeline spanning the CSSC signifying the start of treatment zone, RM 296.7
- Will County Forest Preserve, Along East Romeo Road, not directly adjacent to the waterway.

This area of canal has no potable water intake within or immediately downstream of the treatment zone. The nearest potable water intake is Illinois American Water Company located in Peoria, IL at RM 166.2, 130 miles downstream.

Flow velocity through this stretch of waterway is variable and depends on weather conditions. During dry weather, the mean velocity is roughly 0.6 feet/second. Storm conditions can increase this as much as 2 feet/second. Therefore, successful implementation of this response must occur during dry weather when flow is lowest.

Fish habitat is limited along this stretch of the CSSC. The community within this 5-mile reach is primarily composed of common carp, goldfish, and gizzard shad. The available fish habitat is minimal and consists of breaks in the current, pilings, sunken barges, and other obstructions to flow. These areas should be noted and spot treated by boat during operations to ensure coverage if treatment so necessitates.

b. Supporting Agencies: Refer to Asian Carp Rapid Response Plan Sections 2.2 and 2.3

c. Assumptions: Refer to Asian Carp Rapid Response Plan Section 1.6

d. Current Status:

As of September 2009, eDNA sample analysis indicated the presence of silver carp within the Lockport pool, at less than 0.8 mile from electric barrier IIA. This is the farthest upstream detection of these data to date within the CSSC. There have been no positive sightings and/or specimens collected in this area to date. Historical observations of the expansion of Asian carp have shown that bighead carp tend to precede or travel concurrently with silver carp.

One further potential complication is the need for electric barrier II A to be shut down for routine maintenance every six months. Until completion of electric barrier II B, the only defense is barrier I, which is currently equipped to operate at lower maximum voltage and frequency than barrier II.

2. MISSION

To effectively implement rapid response measures against Asian carp within this section of the CSSC to control their further expansion towards the Great Lakes.

3. EXECUTION

a. Incident Commander's Objectives:

- Maintain essential operations to ensure mission completion during rapid response.
- Inform and prepare all supporting personnel before and during operations.
- Maintain safety and security of on-site operations.

b. Concept of Operations:

The information included within this section is specific for operations within the specified area of the Lockport Pool of the CSSC. Refer to the Asian Carp Rapid Response Plan Section 2.4 for additional important information regarding the overall Concept of Operations.

1. Triggers:

The Asian Carp Rapid Response Workgroup has deemed the following triggers will elicit rapid response operations:

- Positive confirmation of Asian carp between Barrier II and Barrier I
- Barrier Maintenance
- Catastrophic failure of the electric barrier system assuming fish can be contained downstream of electric barrier system

2. Communications:

It will be important for all partner organizations and agencies to communicate with external and internal sources regarding all phases of the rapid response to coordinate actions. Refer to Paragraph A-5, Command and Signal below.

3. Continuity of Operations (COOP):

This section of the Lockport Pool of the CSSC including the Lockport Lock and Dam will be closed to all boat traffic for the duration of operations including staging, application, detoxification, and clean-up actions, and demobilization. Midwest Generation Power Plant will continue operations; however coal will not be moved along the waterway to and from their facility for the duration of operations. This facility utilizes water from the CSSC to create power; therefore in order to maintain operations during the rapid response silt curtains or another type of netting will be places around their intake pipes to keep large fish and debris from entering and clogging their pipes and keep them from going into a catastrophic shutdown. Response Personnel will also need to be places at these intakes to collect any small fish and debris that collect within their trash racks to keep water flowing.

4. Coordinating Instructions:

- Upon activation of plan a command structure will be established in accordance with NIMS ICS and following throughout entire rapid response.
- The Rapid Response Incident Management Team (RRIMT) will meet together or by conference call to coordinate recommendations to the IC/UC on developments and response issues. The RRT will be comprised of personnel qualified to evaluate and assess the situation and its impact on installation operation and security, and develop courses of action.
- Employ PPE, as appropriate
- Follow established protocols for maintaining security
- Identify environmental considerations
- Publish succession of leadership comprising of at least three tiers
- Identify and train a primary and backup for each mission-essential task
- Take necessary steps to maintain accurate personnel accountability
- Capture and document associated costs
- Apply lessons learned from previous related rapid responses and exercises
- Conduct After-Action reviews and submit lessons learned within four weeks of response termination
- Prepare for subsequent responses.

5. Key Tasks:

Key Tasks*	No. of Personnel	Responsibilities
Upon notification of an imminent Rapid Response; final check of application parameters and identify locations for additional control measures		Activate call-down list
Delineate Scope of Infestation		IEPA
Decision to initiate Rapid Response		PIO to issues press releases, post signage, etc
Notification of stakeholder and partner agencies		Coast Guard to shut down commercial navigation and USACE to close locks IDNR/Midwest Gen to block net across their intakes
HASP written and reviewed		IDR/ Incident Management Staff
Disseminate information to the public to increase awareness		Security, fencing, waterway shutdown, etc
Initiate control measures to halt further movement of fish in or out of area		Utilize treatment matrix for decision
Establish Command Post, staging areas, support zones, and JIC		IDNR may lead with support from IEPA, EPA, Dept of Ag
Secure treatment and staging areas		Credentialing if necessary
Treatment Selection		All response personnel
Obtain all necessary permits and clearance for application		PSC
Personnel check in/out procedures		IDNR with conservation police to develop necessary procedures
Review of Concept of Operations, hazards, HASP, emergency procedures, and security with all applicable personnel		IDNR with all participating agencies
Situation briefing		IDNR/subcontractor
Ops Coordination		HSO
Final flow measurements		Spot, boat treatments if necessary
Calibration of equipment		Boats in the water at various locations
Tailgate Health and Safety meeting		If necessary
Treatment Application		DNR/Natural History Survey
Dose Monitoring during application		Natural History Survey, Notre Dame, Barrier Monitoring team -from 1 week to ongoing
Neutralization/detoxification		Operations section –IDNR/support agencies/subcontractor
Chemical concentration monitoring with sentinel fish downstream in Brandon		Subcontractor
Follow up monitoring		Removal of application booms, equipment, etc.
Fish cleanup/removal		PIO task
Disposal of waste		Contractor with input agency input
Demobilization		Activate call-down list
Press Releases		IEPA
After Action Report		PIO to issues press releases, post signage, etc

* Does not factor in weather or other unexpected event that may alter or add additional tasks to this rapid response.

6. Supporting Tasks:

Finance and Administration Office

- Provide guidance for, implement, and document all cost capturing methods and activities
- Assist the UC in programming requirements
- Identify system gaps that will require additional resources
- Determine when work limitations are implemented and non-essential personnel should be released.

Health and Safety

- Develop standard operating procedures (SOPs) for the proper use of PPE
- Train personnel in self-protection, use of appropriate PPE, and safe evacuation from potential unplanned catastrophic event
- Preparation and review of Health and Safety Plan (HASP) prior to response.

Environmental Unit

- Identify environmental issues during the pre-response phase, and resolve any environmental issues that arise during and following response
- Ensure cleanup and disposal is done according to applicable laws and regulations
- Obtain necessary permits required for treatment application, detoxification, and disposal
- Provide subject matter expertise to the unit conducting application, detoxification, and disposal operations.

Law Enforcement and Security Division

- Prioritize security at key locations onsite based on available manpower
- Secure storage and staging locations
- Determine security and patrol staffing needs for sites on land and water.
- Advise the IC/UC when the Security force cannot maintain minimum staffing and when augmentation forces should be requested.

Operations Center

- Maintain, update, exercise, and be prepared to execute this Rapid Response Plan
- Ensure EOC SOPs are current and sufficient staff is trained to respond
- Consolidate organizational requests for manpower assistance
- Coordinate needed outside assistance with supporting agencies through existing Interagency agreements (See Appendix N)
- Conduct after-action reviews and publish After Action Reports (AAR) for any exercises or responses
- Refer incoming calls to appropriate liaison officers.

Public Information Section

- Provide informational forums for the community prior to response activities
- Prepare public affairs plans, information papers, and question-and-answer products
- Communicate with local, national, or international media during all phases of response to ensure uniform and transparent messaging
- Refer incoming calls to appropriate agency or Public Information Officer (PIO).

4. ADMINISTRATION AND LOGISTICS

a. Concept of Support:

Refer to Asian Carp Rapid Response Plan Section 3.0. Efficient response operations will depend on the coordination and support lent by partner agencies.

b. Resources and Assets: Refer to Appendix B for pre-arranged agency support

c. Personnel:

All rapid response supporting agencies should list operations-essential positions and personnel to fill each position, with a backup capable of fulfilling the designated role if needed.

d. Cost Capturing: Refer to Asian Carp Rapid Response Plan Section 3.1.2

5. COMMAND AND SIGNAL

a. Command and Control:

- IDNR has overall direction and control of Asian Carp Rapid Response activities in this area.
- When all or part of the plan is activated, each organization will pool designated resources for response under the direction of the logistics section chief.
- Command-essential information is maintained in the designated emergency operations center (EOC).
- Waterway closures and personnel assignments are communicated via the established chain of command.

b. Signal:

- Communications are via 2-way radio, cellular telephones, facsimile machines, electronic mail, and internet websites.

Annex 2

Des Plaines River Rapid Response Operations

ANNEX 2: DES PLAINES RIVER RAPID RESPONSE OPERATIONS

This Annex provides a plan to carry out Rapid Response operations for Asian Carp control within the Des Plaines River.

1. SITUATION

a. General

1. Lead Department: Illinois Department of Natural Resources (IDNR)
2. Background: Refer to Asian Carp Rapid Response Plan Section 1.4
3. Site Description:

The section of the Des Plaines River under consideration for treatment runs roughly from RM 297, just upstream of Romeo Rd, to RM 302.5. This section of the river consists of several backwater and wetland areas that may be accessible to Asian carp and other fish during periods of high water, and subsequently trapped here as the river recedes. These areas (see Figure 3 for exact locations) are considered optimal habitat for Asian carp. The river is considered navigable and mostly channelized. It was channelized because diversion of this section of river was necessary for proper placement of the CSSC; much of the river has a flat bedrock bottom and vertical limestone sides. This area of river is generally shallow, ranging in dept from less than 1 foot to about 4 feet, and can be walked across in several locations. The stretch of river running parallel to the CSSC is less than 100 yards away in some locations, and during periods of heavy rainfall, flood waters can run into the CSSC above the barrier system—potentially creating a means for Asian carp to evade the electric barrier system. A series of sluice gates connect overflow from the Ship and Sanitary Canal to the Des Plaines River at Isle a la Cache (RM 296.5), increasing the river's flow. At this location, the river also begins its 20-foot drop to the level of the Ship and Sanitary Canal. The river and the canal join south of the Lockport Lock.

Distinguishing characteristics along or within the Des Plaines River from Des Plaines RM 297 to RM 302.5:

- Access Road via Lemont Road adjacent to river along the southern bank from Des Plaines RM 300 to RM 303
- Access points/boat ramps, Des Plaines RM 300 and RM 301.6
- Backwater Area #1 (potential sampling location), Des Plaines RM 302.15 to RM 302.4
- Lemont Road and Railroad Bridge, Des Plaines RM 301.2
- Goose Lake inlet (potential sampling location), Des Plaines RM 300.2
- I-355 Bridge, Des Plaines RM 299.65
- Backwater Area #3 (potential sampling location), Des Plaines RM 297.4 to RM 298.

This area of the river has no potable water intake structure within or immediately downstream of the treatment zone. The nearest potable water intake is Illinois American Water Company located in Peoria, IL at RM 166.2, over 130 miles downstream, and would not be affected by potential treatment actions.

The nearest U.S. Geological Survey (USGS) monitoring station along this span of the Des Plaines River near Romeoville is at RM 296.1. Periodic field measurements at this station that measure stream flow indicate a flow of 317 cubic feet per second (cfs) during warm months with low precipitation, and over 3000 cfs during the spring season under thawing conditions and higher precipitation. Field measurements taken at various locations along

this stretch of river indicated a variable flow rate that ranged from 0.23 feet per second (ft/sec) to 0.89 ft/sec, depending on the location of the waterway.

b. Supporting Agencies: Refer to Asian Carp Rapid Response Plan Sections 2.2 and 2.3

c. Assumptions: Refer to Asian Carp Rapid Response Plan Section 1.6

d. Current Status:

As of September, 2009, eDNA sample analysis indicated the presence of silver carp within the 10-mile stretch of the Des Plaines River after its confluence with the CSSC. The positive eDNA result was at least 5 miles upstream of where the electric barriers are located in the CSSC. The eDNA testing technology is not currently equipped to detect the presence of bighead carp; however, historical observations of the expansion of Asian carp have shown that bighead carp tend to precede or travel concurrently with silver carp.

One further potential complication merits attention: hydrologic data indicate that flooding in this area could submerge certain lands between the Des Plaines River and the CSSC, creating a bridge by which Asian carp and other fish could swim within the current into the CSSC above the barrier and have a clear path into Lake Michigan.

2. MISSION

To extensively monitor this stretch of the Des Plaines River for signs of Asian Carp and to effectively implement control measures to prevent any Asian carp within this section of the Des Plaines River from getting into CSSC.

3. EXECUTION

a. Incident Commander's Objectives:

- Maintain essential operation to ensure mission completion during rapid response.
- Inform and prepare all supporting personnel before and during operations.
- Maintain safety and security of on-site operations.

b. Concept of Operations

The information included within this section is specific for operations within the specified area of the Des Plaines River. Refer to the Asian Carp Rapid Response Plan Section 2.4 for additional important information regarding the overall Concept of Operations.

1. Triggers:

The Asian Carp Rapid Response Workgroup has deemed the following triggers will elicit rapid response operations:

- Positive confirmation of Asian carp between Barrier II and Barrier I
- Barrier Maintenance
- Catastrophic failure of the electric barrier system
- Overland flooding allowing for bypass to the electric barrier by fish
- Positive confirmation of Asian carp upstream of the Barrier I in the CSSC.

2. Communications:

It will be important for all partner organizations and agencies to communicate with external and internal sources regarding all phases of the rapid response to coordinate actions. Refer to Paragraph A-5, Command and Signal below.

3. Continuity of Operations (COOP):

This section of the Des Plaines will be closed to all boat traffic for the duration of operations including application, detoxification, and clean-up actions.

4. Coordinating Instructions:

- Upon activation of plan a command structure will be established in accordance with NIMS ICS and following throughout entire rapid response.
- The Rapid Response Incident Management Team (RRIMT) will meet together or by conference call to coordinate recommendations to the UC on developments and response issues. The RRT will be comprised of personnel qualified to evaluate and assess the situation and its impact on installation operation and security, and develop courses of action.
- Employ PPE, as appropriate
- Follow established protocols for maintaining security
- Identify environmental considerations
- Publish succession of leadership comprising of at least three tiers
- Identify and train a primary and backup for each mission-essential task
- Take necessary steps to maintain accurate personnel accountability
- Capture and document associated costs
- Apply lessons learned from previous related rapid responses and exercises
- Conduct After-Action reviews and submit lessons learned within four weeks of response termination
- Prepare for subsequent responses.

5. Key Tasks: IDNR to amend plan based on additional data needs and assessments of this location.

6. Supporting Tasks:

IDNR may include amendments to this section based on further assessments and additional data gathering of this location, however the following units should be considered:

<u>Finance and Administration Office</u>

- Provide guidance for, implement, and document all cost capturing methods and activities
- Assist the UC in programming requirements
- Identify system gaps that will require additional resources
- Determine when work limitations are implemented and non-essential personnel should be released.

<u>Health and Safety</u>

- Develop standard operating procedures (SOPs) for the proper use of PPE

- Train personnel in self-protection, use of appropriate PPE, and safe evacuation from potential unplanned catastrophic event
- Preparation and review of Health and Safety Plan (HASP) prior to response.

Environmental Unit

- Identify environmental issues during the pre-response phase, and resolve any environmental issues that arise during and following response
- Ensure cleanup and disposal is done according to local laws and regulations
- Obtain necessary permits required for treatment application, detoxification, and disposal
- Provide subject matter expertise to the unit conducting application, detoxification, and disposal operations.

Law Enforcement and Security Division

- Prioritize security at key locations onsite based on available manpower
- Secure storage and staging locations
- Determine security and patrol staffing needs for sites on land and water.
- Advise the UC when the Security force cannot maintain minimum staffing and when augmentation forces should be requested.

Operations Center

- Maintain, update, exercise, and be prepared to execute this Rapid Response Plan
- Ensure EOC SOPs are current and sufficient staff is trained to respond
- Consolidate organizational requests for manpower assistance
- Coordinate needed outside assistance with supporting agencies through existing Interagency agreements (See Appendix N)
- Conduct after-action reviews and publish After Action Reports (AAR) for any exercises or responses
- Refer incoming calls to appropriate liaison officers.

Public Information Section

- Provide informational forums for the community prior to response activities
- Prepare public affairs plans, information papers, and question-and-answer products
- Communicate with local, national, or international media during all phases of response to ensure uniform and transparent messaging
- Refer incoming calls to appropriate agency or Public Information Officer (PIO).

4. ADMINISTRATION AND LOGISTICS

a. Concept of Support:

Refer to Asian Carp Rapid Response Plan Section 3.0. Efficient response operations will depend on the coordination and support lent by partner agencies.

b. Resources and Assets: Refer to Appendix B for pre-arranged agency support

c. Personnel:

All rapid response supporting agencies should list operations-essential positions and personnel to fill each position, with a backup capable of fulfilling the designated role if needed.

d. Cost Capturing: Refer to Asian Carp Rapid Response Plan Section 3.1.2

5. COMMAND AND SIGNAL

a. Command and Control:

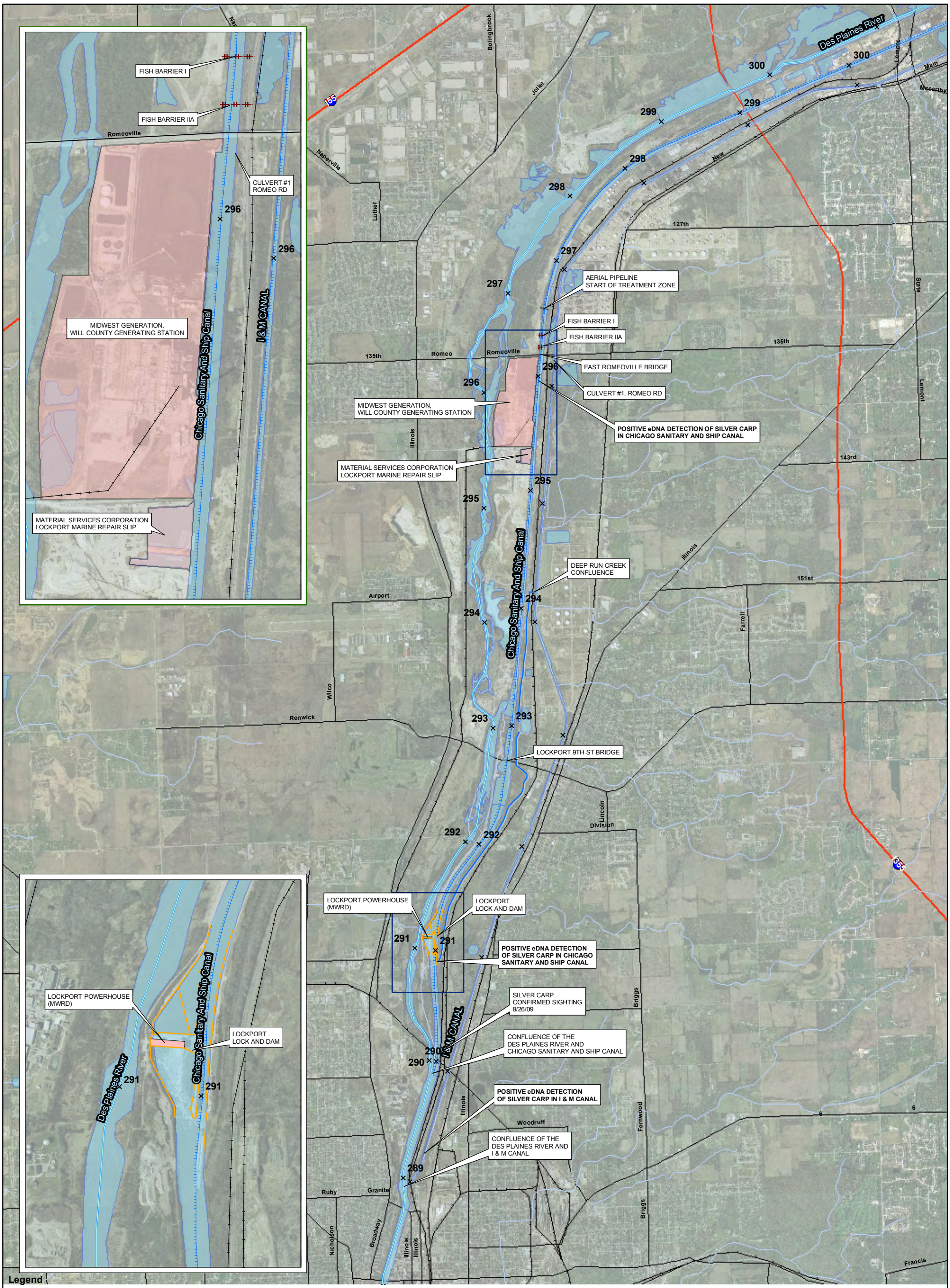
- IDNR has overall direction and control of Asian Carp Rapid Response activities in this area.
- When all or part of the plan is activated, each organization will pool designated resources for response under the direction of the logistics section chief.
- Command-essential information will be maintained in the designated EOC.
- Waterway closures and personnel assignments will be communicated via the established chain of command.

b. Signal:

- Communications will be made via 2-way radio, cellular telephones, facsimile machines, electronic mail, and internet websites.

Appendix A

Figures 1 through 5



DES PLAINES RIVER ASIAN CARP STUDY

FIGURE 1

TETRA TECH EM INC.

BACKWATER AREA NUMBER 3

Des Plaines River

Chicago Sanitary And Ship Canal

I & M CANAL

BACKWATER AREA NUMBER 2
GOOSE LAKE

BACKWATER AREA NUMBER 1

POSITIVE eDNA DETECTION OF SILVER CARP

298 299 300 301 302

Romeoville

Legend

- RIVER MILES
- OTHER STREAMS AND RIVERS
- NAVIGATABLE RIVERS
- CHICAGO SANITARY AND SHIP CANAL AND I & M CANAL
- WATER BODIES
- RAILROADS
- INTERSTATE HIGHWAYS
- STATE AND COUNTY HIGHWAYS

N W E S

0 1,500 3,000 Feet

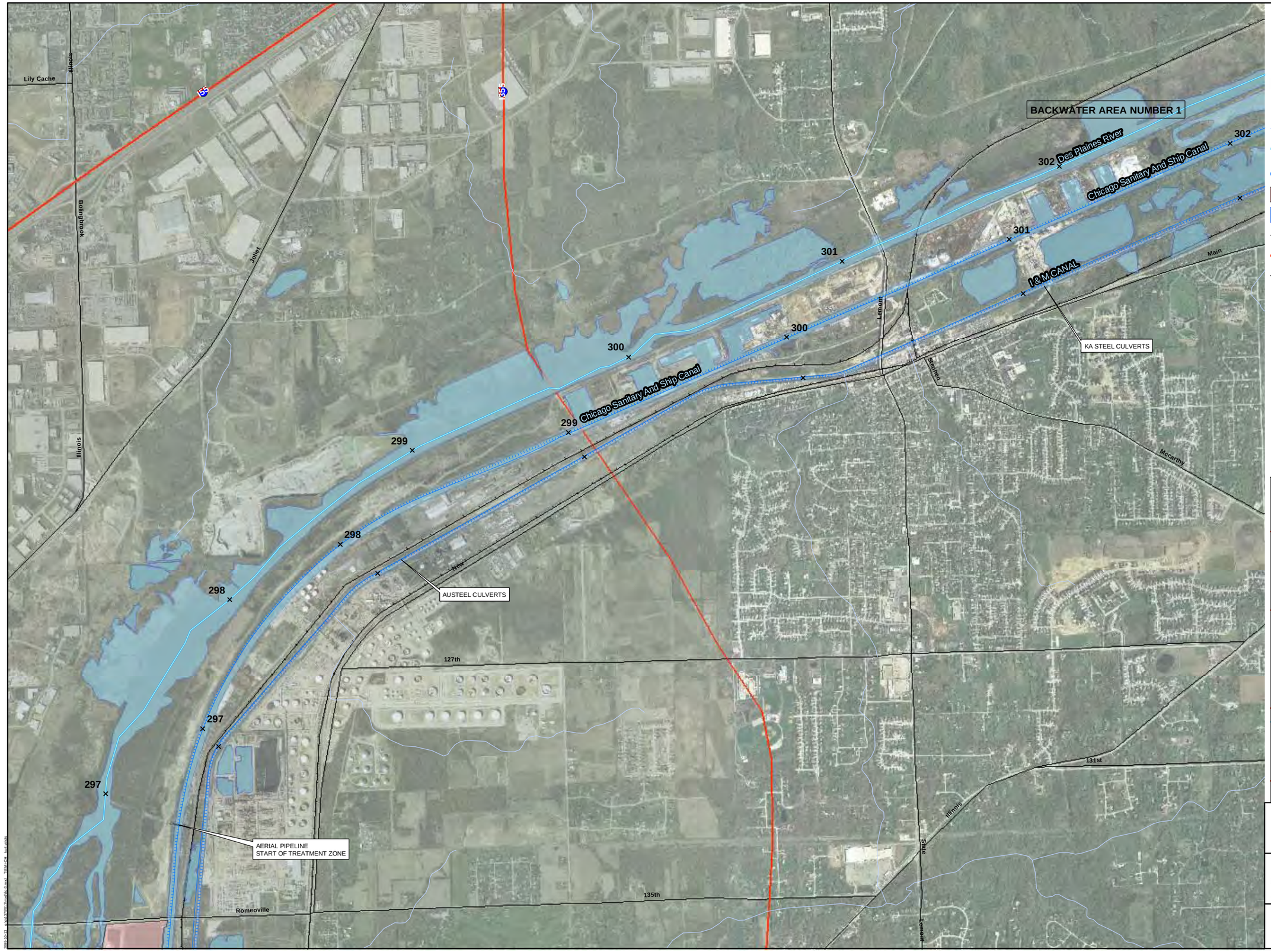
Lake Michigan

MAP LOCATION

DES PLAINES RIVER
ASIAN CARP STUDY

FIGURE 2
DES PLAINES RIVER
TREATMENT AREA

TETRA TECH EM INC.

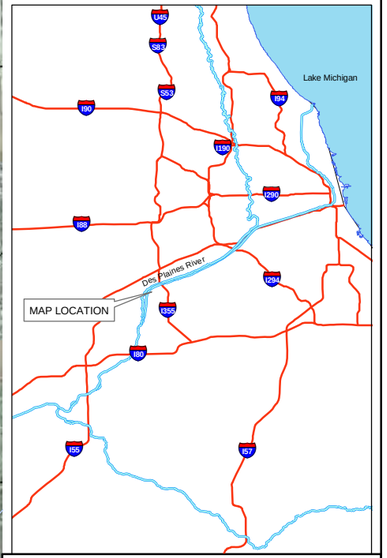


Legend

- RIVER MILES
- OTHER STREAMS AND RIVERS
- BACKWATER RIVERS
- CHICAGO SANITARY AND SHIP CANAL AND I & M CANAL
- Points of Interest
- WATER BODIES
- RAILROADS
- INTERSTATE HIGHWAYS
- STATE AND COUNTY HIGHWAYS

N
W E
S

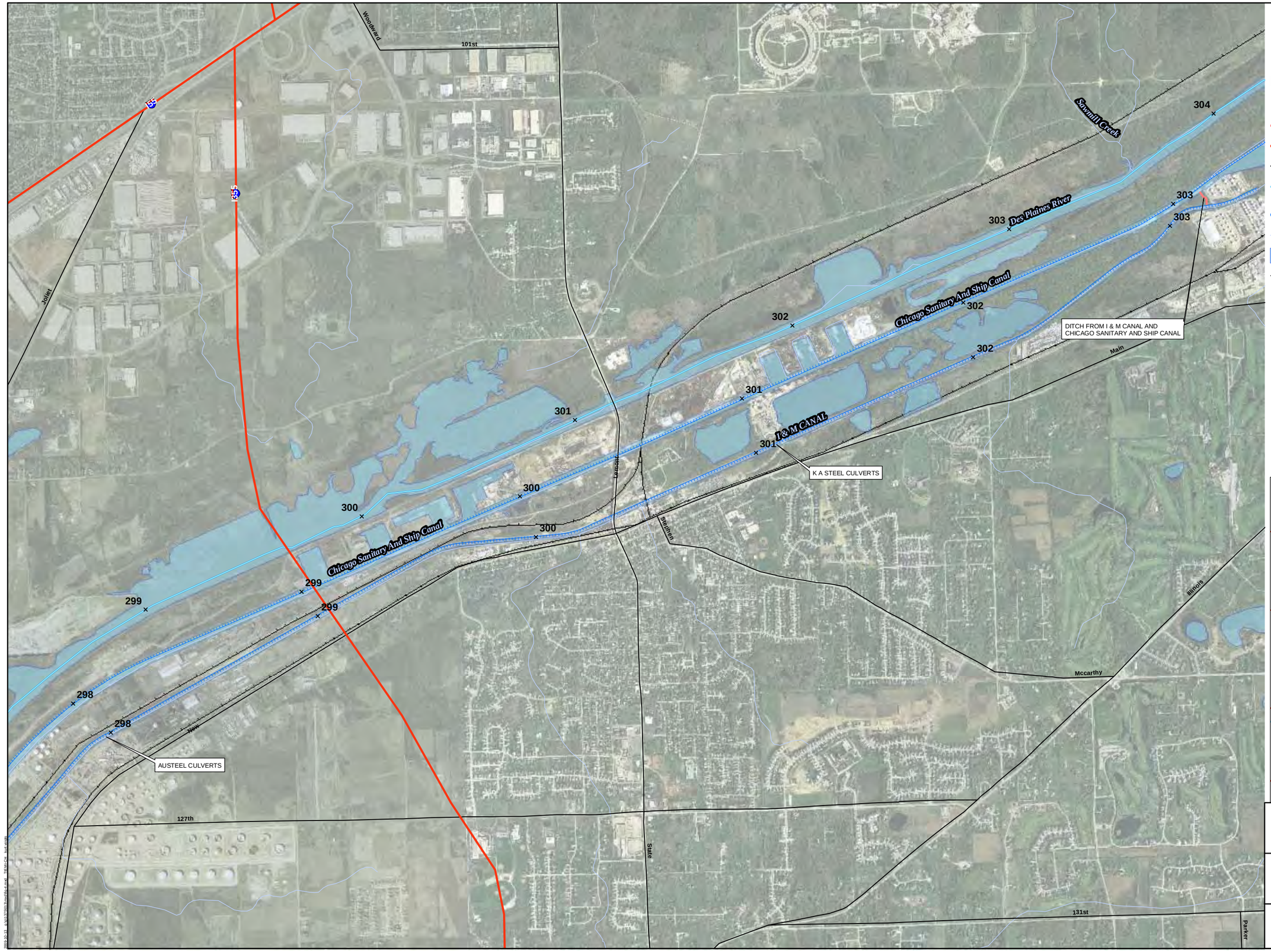
0 1,500 3,000 Feet



DES PLAINES RIVER
ASIAN CARP STUDY

FIGURE 3
CHICAGO SANITARY AND SHIP CANAL
AND I & M CANAL TREATMENT AREAS

TETRA TECH EM INC.

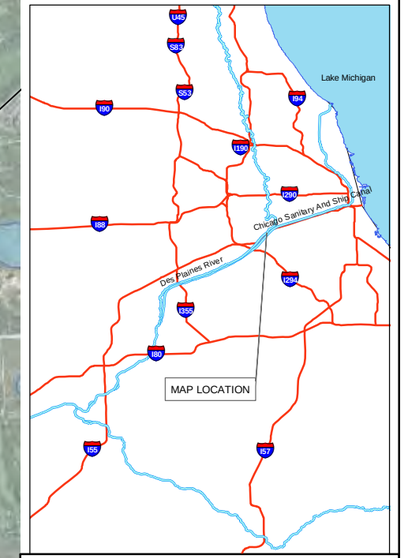


Legend

- RIVER MILES
- DITCH CONNECTIONS
- INTERSTATE HIGHWAYS
- STATE AND COUNTY HIGHWAYS
- NAVIGATABLE RIVERS
- CHICAGO SANITARY AND SHIP CANAL AND I & M CANAL
- RIVERS AND STREAMS
- Water_Bodies
- Railroads

N
W E
S

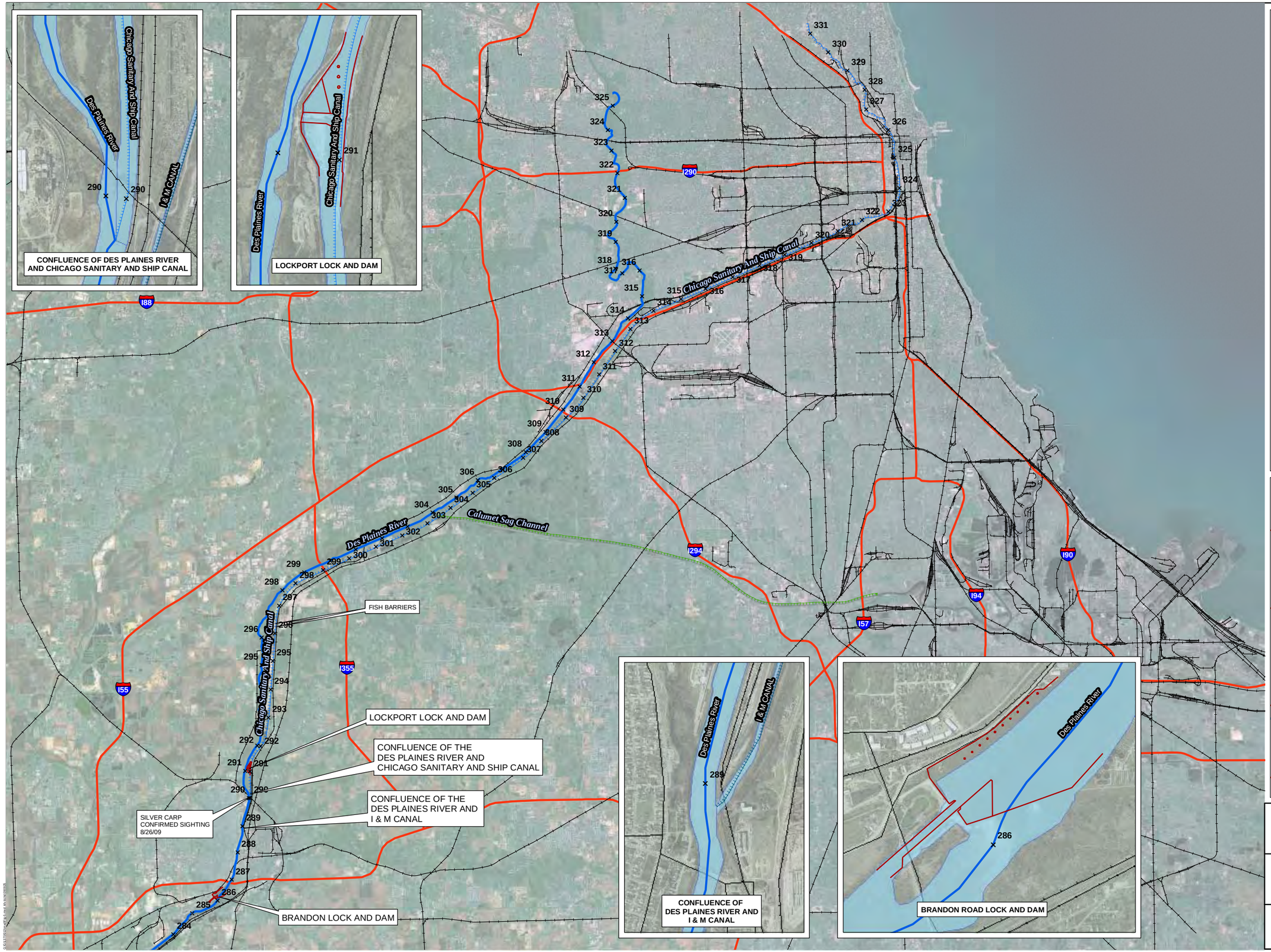
0 1,000 2,000 Feet



DES PLAINES RIVER
ASIAN CARP STUDY

FIGURE 4
I & M CANAL
AREAS OF CONCERN

TETRA TECH EM INC.



Legend

- River_Miles
- FISH BARRIER
- RIVER FEATURES
- NAVIGATABLE RIVERS
- CHICAGO SANITARY AND SHIP CANAL
- CALUMET SAG CHANNEL
- Railroads
- INTERSTATE HIGHWAYS

N W E S

0 2 4 Miles

DES PLAINES RIVER
ASIAN CARP STUDY

FIGURE 5

TETRA TECH EM INC.

Appendix B

Resources and Assets for All Locations

Appendix B
Resources and Assets for All Locations

Chemical Assets

Assets Needed	Asset in Inventory? (Yes/No)	Units	Available For Rapid Response?	Time of Year Equipment Available For Use	Equipment Location (City, State)	Notes/Comments	Agency/Organization	Contact Information
Chemical Applicant (Rotenone, Antimycin, etc.)	YES	375	YES	Year-round	IL (various locations)	Rotenone- 4 gal. 5% liquid 371 gal. 2.5% synergized	IDNR	Steve Shults (618) 435-8138 X123
Chemical Applicant (Rotenone, Antimycin, etc.)	YES	35	Yes	Any	Marion, IL	5% liquid Rotenone	DOI	Sam Finney, 9053 Route 148, Marion, IL 62959 (618) 997-6869
Chemical Applicant (Rotenone, Antimycin, etc.)	YES	390 gals	YES	Any	Madison, WI	Rotenone- liquid 2.5% synergized	WIDNR	Michael Staggs (608) 267-0796
Chemical Applicant (Rotenone, Antimycin, etc.)	YES	400 gals	YES	Any	Plainwell, MI	Rotenone- liquid 2.5% synergized	MDNR	Jim Dexter 269-685-6851 x 116
Chemical Applicant (Rotenone, Antimycin, etc.)	YES	5170 lbs	YES*	Any	Hutchinson, MN	Powder Rotenone	Minnesota DNR	Jay Rendall 651-259-5131 jay.rendall.dnr.state.mn.us
Neutralizing Agent (Citric Acid, KMnO4, etc.)	YES	14,300 Lbs	YES	Year-round	Plainwell, MI	KMn04	MDNR	Jim Dexter 269-685-6851 x 116
Neutralizing Agent (Citric Acid, KMnO4, etc.)	YES	1,700 lbs.	YES	Year-round	IL (various locations)	KMn04	IDNR	Steve Shults (618) 435-8138 X123
Neutralizing Agent (Citric Acid, KMnO4, etc.)	YES	590 lbs.	YES	Year-round	Pennsylvania	KMn04	Pennsylvania	Leroy M. Young, Jr., Director Penn. Fish and Boat Commission 814-359-5177

* Available if replaced by next year for use

Appendix B
Resources and Assets for All Locations

Data Collection Assets

Assets Needed	Asset in Inventory? (Yes/No)	Units	Available For Rapid Response?	Time of Year Equipment Available For Use	Equipment Location (City, State)	Notes/Comments	Agency/Organization	Contact Information
GPS Units (Handheld/Backpack/Boat-mounted)	YES	6	YES	Whenever Needed they will be made available	Marion, IL	2 handheld, 2 boat, 2 truck	USFWS Carterville Fish and Wildlife Conservation Office	Sam Finney, 9053 Route 148, Marion, IL 62959 (618) 997-6869
GIS Software	YES	?	YES	Year-Round*	Columbia, MO	Availability dependent on workload feasibility	USFWS, Columbia FWCO	USFWS, Columbia FWCO
GPS Units (Handheld/Backpack/Boat-mounted)	YES	3	YES	Year-Round*	Columbia, MO	Availability dependent on time needed Handheld/boat types	USFWS, Columbia FWCO	USFWS, Columbia FWCO
GIS Software	YES	5	YES	Any	Chicago, IL	Currently on laptos	Dept. of Environment	Kevin Schnoes 312-744-4034
GPS Units (Handheld/Backpack/Boat-mounted)	YES	1	YES	Any	Chicago, IL	Backpack	Dept. of Environment	Kevin Schnoes 312-744-4034
GIS Software	Yes	1	Yes	Any	Springfield, IL		USDA WS	Timothy White
GPS Units (Handheld/Backpack/Boat-mounted)	Yes	4	Yes	Any	Springfield, IL		USDA WS & VS	Timothy White WS / Kathy Burda VS
GPS Units (Handheld/Backpack/Boat-mounted)	YES	3	YES	Whenever needed they will be made available	La Crosse, WI		US FWS La Crosse Fish and Wildlife Conservation Office	Pam Thiel Onalaska, WI 54650 pam_thiel@fws.gov 608-783-8431

* Availability dependent on workload feasibility at time of request

Appendix B
Resources and Assets for All Locations

Fish Collection Assets

Assets Needed	Asset in Inventory? (Yes/No)	Units	Available For Rapid Response?	Time of Year Equipment Available For Use	Equipment Location (City, State)	Notes/Comments	Agency/Organization	Contact Information
Electroshocking Equipment (Boat and Backpack Types)	YES	4	YES	Whenever needed they will be made available	La Crosse, WI	3 boat types, 1 back pack type	US FWS La Crosse Fish and Wildlife Conservation Office	Pam Thiel Onalaska, WI 54650 pam_thiel@fws.gov 608-783-8431
Electroshocking Equipment (Boat and Backpack Types)	YES	2	YES	Year-Round*	Columbia, MO	1 boat type, 1 back pack type	USFWS, Columbia FWCO	USFWS, Columbia FWCO
Large and Small Dip Nets	YES	Numerous	YES	Year-Round*	Columbia, MO		USFWS, Columbia FWCO	USFWS, Columbia FWCO
Large and Small Dip Nets	YES	3	YES	Whenever needed they will be made available	La Crosse, WI	enough for 3 boats	US FWS La Crosse Fish and Wildlife Conservation Office	Pam Thiel Onalaska, WI 54650 pam_thiel@fws.gov 608-783-8431
Large and Small Dip Nets	YES	4	YES	Whenever Needed they will be made available	Marion, IL		USFWS Carterville Fish and Wildlife Conservation Office	Sam Finney, 9053 Route 148, Marion, IL 62959 (618) 997-6869
Large and Small Dip Nets	Yes	4	Yes	Any	Springfield, IL		USDA WS	Timothy White
Large and Small Dip Nets	YES	140	YES	Year-round	IL (various locations)		IDNR	Steve Shults (618) 435-8138 X123
Large and Small Dip Nets	YES	Numerous	YES	Any	Chicago	currently used to remove debris from Chicago River	Dept. of Streets & Sanitation	Kevin Schnoes 312-744-4034
Trammel Nets and Seines	YES	10	YES	Whenever needed they will be made available	La Crosse, WI		US FWS La Crosse Fish and Wildlife Conservation Office	Pam Thiel Onalaska, WI 54650 pam_thiel@fws.gov 608-783-8431
Trammel Nets and Seines	YES	4	YES	Whenever Needed they will be made available	Marion, IL	Trammel	USFWS Carterville Fish and Wildlife Conservation Office	Sam Finney, 9053 Route 148, Marion, IL 62959 (618) 997-6869
Trammel Nets and Seines	YES	20	YES	Year-round	IL (various locations)		IDNR	Steve Shults (618) 435-8138 X123
Trammel Nets and Seines	YES	Numerous	YES	Year-Round*	Columbia, MO		USFWS, Columbia FWCO	USFWS, Columbia FWCO
Minnow Nets	YES	Numerous	YES	Year-Round*	Columbia, MO		USFWS, Columbia FWCO	USFWS, Columbia FWCO
Minnow Nets	YES	10	YES	Year-round	IL (various locations)		IDNR	Steve Shults (618) 435-8138 X123
Gill Nets	YES	20	YES	Whenever needed they will be made available	La Crosse, WI		US FWS La Crosse Fish and Wildlife Conservation Office	Pam Thiel Onalaska, WI 54650 pam_thiel@fws.gov 608-783-8431
Gill Nets	YES	5	YES	Whenever Needed they will be made available	Marion, IL		USFWS Carterville Fish and Wildlife Conservation Office	Sam Finney, 9053 Route 148, Marion, IL 62959 (618) 997-6869
Gill Nets	YES	100	YES	Year-round	IL (various locations)		IDNR	Steve Shults (618) 435-8138 X123
Gill Nets	YES	Numerous	YES	Year-Round*	Columbia, MO		USFWS, Columbia FWCO	USFWS, Columbia FWCO
Fyke Nets	YES	Numerous	YES	Year-Round*	Columbia, MO		USFWS, Columbia FWCO	USFWS, Columbia FWCO
Fyke Nets	YES	6	YES	Whenever Needed they will be made available	Marion, IL	MINI Type	USFWS Carterville Fish and Wildlife Conservation Office	Sam Finney, 9053 Route 148, Marion, IL 62959 (618) 997-6869
Fyke Nets	YES	100	YES	Year-round	IL (various locations)		IDNR	Steve Shults (618) 435-8138 X123
Fyke Nets	YES	10	YES	Whenever needed they will be made available	La Crosse, WI		US FWS La Crosse Fish and Wildlife Conservation Office	Pam Thiel Onalaska, WI 54650 pam_thiel@fws.gov 608-783-8431

* Availability dependent on workload feasibility at time of request

Appendix B
Resources and Assets for All Locations

Chemical Application Assets

Assets Needed	Asset in Inventory? (Yes/No)	Units	Available For Rapid Response?	Time of Year Equipment Available For Use	Equipment Location (City, State)	Notes/Comments	Agency/Organization	Contact Information
Chemical Pumps	YES	20	YES	Year-round	IL (various locations)		IDNR	Steve Shults (618) 435-8138 X123
Metal Drums	YES	20	YES	Any	Chicago, IL	Estimate - more potentially available	Dept. of Environment	Kevin Schnoes 312-744-4034
Backpack Sprayers	YES	Multiple	YES	Any	Madison, WI		WIDNR	Michael Staggs (608) 267-0796
ATV Sprayers	YES	Multiple	YES	Any	Madison, WI		WIDNR	Michael Staggs (608) 267-0796
Boat Application System	YES	4	YES	Any	Madison, WI	powder or liquid application	WIDNR	Michael Staggs (608) 267-0796
Drip Barrel Station Set-Ups	YES	20+	YES	Any	Madison, WI	have components for 30 additional stations if needed	WIDNR	Michael Staggs (608) 267-0796
Spill Response Kit	YES	10	YES	Any	Chicago, IL		Dept. of Environment	Kevin Schnoes 312-744-4034

* Availability dependent on workload feasibility at time of request

Appendix B
Resources and Assets for All Locations

Transportation Assets

Assets Needed	Asset in Inventory? (Yes/No)	Units	Available For Rapid Response?	Time of Year Equipment Available For Use	Equipment Location (City, State)	Notes/Comments	Agency/Organization	Contact Information
Flat-bottom Boat (With Trailer)	YES	35	YES	Year-round	IL (various locations)	Boats	IDNR	Steve Shults (618) 435-8138 X123
Flat-bottom Boat (With Trailer)	Yes	1	Yes	Any*	Springfield, IL	Shallow Drive Motor	USDA WS	Timothy White
Flat-bottom Boat (With Trailer)	YES	2	YES	Whenever Needed they will be made available	Marion, IL		USFWS Carterville Fish and Wildlife Conservation Office	Sam Finney, 9053 Route 148, Marion, IL 62959 (618) 997-6869
Flat-bottom Boat (With Trailer)	YES	3	YES	Whenever needed they will be made available	La Crosse, WI		US FWS La Crosse Fish and Wildlife Conservation Office	Pam Thiel Onalaska, WI 54650 pam_thiel@fws.gov 608-783-8431
18 foot boats	Yes	2	Yes	Any	Canada	18 foot	Canada	Becky Cudmore 905-336-4474
Boats	Yes	3	Yes	Any	Indiana	16 foot	Indian DNR	
Flat-bottom Boat (With Trailer)	YES	1	YES	Any	Chicago, IL	20 foot. Used to remove debris from Chicago River	Dept. of Streets & Sanitation	Kevin Schnoes 312-744-4034
Flat-bottom Boat (With Trailer)	YES	6	YES	Year-Round*	Columbia, MO		USFWS, Columbia FWCO	USFWS, Columbia FWCO
Air Boat	YES	1	YES	Any	Madison, WI	With spray rig	WIDNR	Michael Staggs (608) 267-0796
Outboard Boat Motors	YES	3	YES	Whenever Needed they will be made available	Marion, IL		USFWS Carterville Fish and Wildlife Conservation Office	Sam Finney, 9053 Route 148, Marion, IL 62959 (618) 997-6869
Outboard Boat Motors	YES	1	YES	Year-Round*	Columbia, MO	10 horsepower	USFWS, Columbia FWCO	USFWS, Columbia FWCO
Other Boats, Canoes, etc.	YES	1	YES	Year-Round*	Columbia, MO	One small johnboat	USFWS, Columbia FWCO	USFWS, Columbia FWCO
Other Boats, Canoes, etc.	YES	1	YES	Whenever Needed they will be made available	Marion, IL		USFWS Carterville Fish and Wildlife Conservation Office	Sam Finney, 9053 Route 148, Marion, IL 62959 (618) 997-6869
Other Boats, Canoes, etc.	Yes	2	Yes	Any*	Springfield, IL	Creek Boat Kayak	USDA WS	Timothy White
Other Boats, Canoes, etc.	YES	5	YES	Any	Chicago, IL	Canoes	Dept. of Environment	Kevin Schnoes 312-744-4034
Trucks	YES	2	YES	Whenever Needed they will be made available	Marion, IL		USFWS Carterville Fish and Wildlife Conservation Office	Sam Finney, 9053 Route 148, Marion, IL 62959 (618) 997-6869
Trucks	YES	Multiple	YES	Any	Chicago, IL	Items typcially available through Office of Emergency Management & Communications (OEMC)	City of Chicago	Kevin Schnoes 312-744-4034
Trucks	YES	Multiple	YES	Year-Round*	Columbia, MO		USFWS, Columbia FWCO	USFWS, Columbia FWCO

* Availability dependent on workload feasibility at time of request

Appendix B
Resources and Assets for All Locations

Health and Safety Assets

Assets Needed	Asset in Inventory? (Yes/No)	Units	Available For Rapid Response?	Time of Year Equipment Available For Use	Equipment Location (City, State)	Notes/Comments	Agency/Organization	Contact Information
PPE (Tyvek, gloves, respirators, etc.)	YES	Numerous	YES	Any	Chicago, IL	Expendable items	Dept. of Environment	Kevin Schnoes 312-744-4034
PPE for Rotenone Application	YES	15	YES	Any	Madison, WI	Enough for staff of 15	WIDNR	Michael Staggs (608) 267-0796
PPE (Tyvek, gloves, respirators, etc.)	Yes	2	Yes	Any	Springfield, IL	supplied with staff	USDA VS	Kathy Burda
Life Vests	Yes	5	Yes	Any	Springfield, IL		USDA WS	Timothy White
Life Vests	YES	10	YES	Whenever Needed they will be made available	Marion, IL		USFWS Carterville Fish and Wildlife Conservation Office	Sam Finney, 9053 Route 148, Marion, IL 62959 (618) 997-6869
Life Vests	YES	Numerous	YES	Any	Chicago, IL		Dept. of Environment	Kevin Schnoes 312-744-4034
First Aid Equipment	YES	Numerous	YES	Any	Chicago, IL	Expendable items	Dept. of Environment	Kevin Schnoes 312-744-4034
Life Vests	YES	Numerous	YES	Whenever needed they will be made available	La Crosse, WI	Enough for FWS staff	US FWS La Crosse Fish and Wildlife Conservation Office	Pam Thiel Onalaska, WI 54650 pam_thiel@fws.gov 608-783-8431
Life Vests	YES	Numerous	YES	Year-Round*	Columbia, MO	Various Sizes of PFD's and Mustang Survival Suits	USFWS, Columbia FWCO	USFWS, Columbia FWCO
First Aid Equipment	Yes	1	Yes	Any	Springfield, IL	Supplied with Vehicles	USDA WS	Timothy White
First Aid Equipment	YES	3 Large Kits	YES	Year-Round*	Columbia, MO	3 Large Pelican Case Kits	USFWS, Columbia FWCO	USFWS, Columbia FWCO
First Aid Equipment	YES	2	YES	Whenever Needed they will be made available	Marion, IL		USFWS Carterville Fish and Wildlife Conservation Office	Sam Finney, 9053 Route 148, Marion, IL 62959 (618) 997-6869

* Availability dependent on workload feasibility at time of request

Appendix B
Resources and Assets for All Locations

Personnel Assets/ Funding

Assets Needed	Asset in Inventory? (Yes/No)	Units	Available For Rapid Response?	Time of Year Equipment Available For Use	Equipment Location (City, State)	Notes/Comments	Agency/Organization	Contact Information
Trained Personnel	YES	Multiple	YES	Year-Round*	Columbia, MO		USFWS, Columbia FWCO	USFWS, Columbia FWCO
Trained Personnel	YES	6	YES	Whenever needed they will be made available	La Crosse, WI	6 Staff trained in fish collection, not chemical treatment	US FWS La Crosse Fish and Wildlife Conservation Office	Pam Thiel 555 Lester Ave Onalaska, WI 54650 pam_thiel@fws.gov 608-783-8431
Trained Personnel	YES	40	YES	Year-round	IL (various locations)	Field Administrators, Biologists, Techs	IDNR	Steve Shults (618) 435-8138 X123
Trained Personnel	YES	Multiple	YES	Any	Milwaukee, WI	Security and other	USCG	Col. Cummins
Trained Personnel	YES	4	YES	Any	Madison, WI	Chemical treatment design staff	WIDNR	Michael Staggs (608) 267-0796
Trained Personnel	YES	25	YES	Any	Madison, WI	Certified Pesticide Applicators in FM	WIDNR	Michael Staggs (608) 267-0796
Trained Personnel	YES	6	YES	Any	Indiana	Trained applicators	Indiana DNR	
Trained Personnel	YES	16	YES	Any	Canada	10 Trained applicator, 6 for cleanup crews	Canada	Becky Cudmore 905-336-4474
Trained Personnel	YES	Multiple	YES	Any	Chicago, IL	Items typcially available through Office of Emergency Management & Communications (OEMC)	City of Chicago	Kevin Schnoes 312-744-4034
Trained Personnel	Yes	5	Yes	Any*	Springfield, IL		USDA WS	Timothy White
Support Volunteers	Yes	2	Yes	Any*	Springfield, IL		USDA VS	Kathy Burda
Support Volunteers	YES	Multiple	YES	Any	Chicago, IL	Items typcially available through Office of Emergency Management & Communications (OEMC)	City of Chicago	Kevin Schnoes 312-744-4034
Support Volunteers	YES	5	YES	All year	Ann Arbor, MI		GLFC	John Dettmers or Marc Gaden
Support Volunteers	YES	3	YES	Whenever needed they will be made available	La Crosse, WI		US FWS La Crosse Fish and Wildlife Conservation Office	Pam Thiel 555 Lester Ave Onalaska, WI 54650 pam_thiel@fws.gov 608-783-8431
Emergency Funding	YES	NA	YES	Any	Chicago, IL	Unknown amount	USEPA-GLNPO	Bill Bolen 312-353-6316
Emergency Funding	YES	NA	YES	Any	Columbus, Ohio	20,000	Ohio Division of Wildlife	Raymond Petering (614) 265-6554
Emergency Funding	YES	NA	YES	All year	Ann Arbor, MI	At least $50,000	GLFC	John Dettmers or Marc Gaden

* Availability dependent on workload feasibility at time of request

Appendix B
Resources and Assets for All Locations

Miscellaneous Assets

Assets Needed	Asset in Inventory? (Yes/No)	Units	Available For Rapid Response?	Time of Year Equipment Available For Use	Equipment Location (City, State)	Notes/Comments	Agency/Organization	Contact Information
Rakes/shovels	YES	50	YES	Any	Chicago, IL	Estimate - numerous items potentially available	Dept. of Streets & Sanitation Dept. of Water Management	Kevin Schnoes 312-744-4034
Excavating Equipment (bobcats, cranes, etc)	YES	5	YES	Any	Chicago, IL	Estimate - more items potentially available	Dept. of Streets & Sanitation Dept. of Water Management	Kevin Schnoes 312-744-4034
buckets/dumpsters	YES	5	YES	Whenever Needed they will be made available	Marion, IL	Buckets	USFWS Carterville Fish and Wildlife Conservation Office	Sam Finney, 9053 Route 148, Marion, IL 62959 (618) 997-6869
buckets/dumpsters	YES	10	YES	Any	Chicago, IL	Estimate - more items potentially available	Dept. of Streets & Sanitation Dept. of Water Management	Kevin Schnoes 312-744-4034
Tarps	YES	Numerous	YES	Year-Round*	Columbia, MO		USFWS, Columbia FWCO	USFWS, Columbia FWCO
Tarps	YES	5	YES	Any	Chicago, IL		Dept. of Environment	Kevin Schnoes 312-744-4034
Communications Devices	YES	2	YES	Whenever Needed they will be made available	Marion, IL	VHF	USFWS Carterville Fish and Wildlife Conservation Office	Sam Finney, 9053 Route 148, Marion, IL 62959 (618) 997-6869
Communications Devices	YES	6	YES	Any	Chicago, IL	Radios programmed with city department frequencies	Dept. of Environment	Kevin Schnoes 312-744-4034
Garden Hoses	YES	20	YES	Year-round	IL (various locations)		IDNR	Steve Shults (618) 435-8138 X123
Garden Hoses	YES	2	YES	Any	Chicago, IL		Dept. of Environment	Kevin Schnoes 312-744-4034
Ropes	YES	4	YES	Whenever Needed they will be made available	Marion, IL	50'	USFWS Carterville Fish and Wildlife Conservation Office	Sam Finney, 9053 Route 148, Marion, IL 62959 (618) 997-6869
Ropes	YES	Numerous	YES	Year-Round*	Columbia, MO		USFWS, Columbia FWCO	USFWS, Columbia FWCO
Cable Ties	YES	Numerous	YES	Year-Round*	Columbia, MO		USFWS, Columbia FWCO	USFWS, Columbia FWCO
Buoys	YES	Numerous	YES	Year-Round*	Columbia, MO		USFWS, Columbia FWCO	USFWS, Columbia FWCO
Buoys	YES	50	YES	Whenever Needed they will be made available	Marion, IL		USFWS Carterville Fish and Wildlife Conservation Office	Sam Finney, 9053 Route 148, Marion, IL 62959 (618) 997-6869
Drum Trucks	YES	2	YES	Any	Chicago, IL		Dept. of Environment	Kevin Schnoes 312-744-4034
Work Gloves	Yes	5	Yes	Any*	Springfield, IL	Supplied with Staff	USDA WS	Timothy White
Work Gloves	YES	4	YES	Whenever Needed they will be made available	Marion, IL		USFWS Carterville Fish and Wildlife Conservation Office	Sam Finney, 9053 Route 148, Marion, IL 62959 (618) 997-6869
Work Gloves	YES	50	YES	Any	Chicago, IL		Dept. of Environment	Kevin Schnoes 312-744-4034
Work Gloves	YES	Numerous	YES	Year-Round*	Columbia, MO	Cotton, dipped cotton and neoprene	USFWS, Columbia FWCO	USFWS, Columbia FWCO
Waders	YES	Numerous	YES	Year-Round*	Columbia, MO	Neoprene	USFWS, Columbia FWCO	USFWS, Columbia FWCO
Waders	Yes	5	Yes	Any	Springfield, IL	Supplied with Staff	USDA WS	Timothy White
Waders	YES	3	YES	Whenever Needed they will be made available	Marion, IL		USFWS Carterville Fish and Wildlife Conservation Office	Sam Finney, 9053 Route 148, Marion, IL 62959 (618) 997-6869
Waders	YES	Numerous	YES	Whenever needed they will be made available	La Crosse, WI	Enough for FWS personnel	US FWS La Crosse Fish and Wildlife Conservation Office	Pam Thiel Onalaska, WI 54650 pam_thiel@fws.gov 608-783-8431

Appendix B
Resources and Assets for All Locations

Assets Needed	Asset in Inventory? (Yes/No)	Units	Available For Rapid Response?	Time of Year Equipment Available For Use	Equipment Location (City, State)	Notes/Comments	Agency/Organization	Contact Information
Waders	YES	2	YES	Any	Chicago, IL		Dept. of Environment	Kevin Schnoes 312-744-4034
Anchors	YES	10	YES	Whenever Needed they will be made available	Marion, IL		USFWS Carterville Fish and Wildlife Conservation Office	Sam Finney, 9053 Route 148, Marion, IL 62959 (618) 997-6869
Anchors	YES	Numerous	YES	Whenever needed they will be made available	La Crosse, WI	Enough for FWS boats	US FWS La Crosse Fish and Wildlife Conservation Office	Pam Thiel Onalaska, WI 54650 pam_thiel@fws.gov 608-783-8431
Anchors	YES	Numerous	YES	Year-Round*	Columbia, MO		USFWS, Columbia FWCO	USFWS, Columbia FWCO
Generators	Yes	2	Yes	Any	Springfield, IL		USDA WS	Timothy White
Generators	YES	2	YES	Year-Round*	Columbia, MO		USFWS, Columbia FWCO	USFWS, Columbia FWCO
Generators	YES	2	YES	Any	Chicago, IL		Dept. of Environment	Kevin Schnoes 312-744-4034
Generators	YES	3	YES	Whenever Needed they will be made available	Marion, IL		USFWS Carterville Fish and Wildlife Conservation Office	Sam Finney, 9053 Route 148, Marion, IL 62959 (618) 997-6869
Generators	YES	1	YES	Whenever needed they will be made available	La Crosse, WI	1 small	US FWS La Crosse Fish and Wildlife Conservation Office	Pam Thiel Onalaska, WI 54650 pam_thiel@fws.gov 608-783-8431
Pumps	Yes	1	Yes	Any	Springfield, IL	2" 30m3/H	USDA WS	Timothy White
Digital Camera	Yes	3	Yes	Any	Springfield, IL		USDA WS &VS	Timothy White WS / Kathy Burda VS
Digital Camera	YES	20	YES	Any	Chicago, IL	Currently in use by DOE field staff	Dept. of Environment	Kevin Schnoes 312-744-4034
Digital Camera	YES	Numerous	YES	Year-Round*	Columbia, MO		USFWS, Columbia FWCO	USFWS, Columbia FWCO
Digital Camera	YES	3	YES	Whenever needed they will be made available	La Crosse, WI		US FWS La Crosse Fish and Wildlife Conservation Office	Pam Thiel Onalaska, WI 54650 pam_thiel@fws.gov 608-783-8431
Digital Camera	YES	2	YES	Whenever Needed they will be made available	Marion, IL		USFWS Carterville Fish and Wildlife Conservation Office	Sam Finney, 9053 Route 148, Marion, IL 62959 (618) 997-6869
Food/Water	YES	Unknown	YES	Any	Chicago, IL	Items typcially available through OEMC	City of Chicago	Kevin Schnoes 312-744-4034
Port-o-potties, Toilet paper, Etc	YES	Numerous	YES	Any	Chicago, IL	Items typcially available through OEMC	City of Chicago	Kevin Schnoes 312-744-4034
Fuel/Oil	YES	Unknown	YES	Any	Chicago, IL	Items typcially available through OEMC	City of Chicago	Kevin Schnoes 312-744-4034
Rain/Sun Shelters	YES	1	YES	Whenever Needed they will be made available	Marion, IL	Awning	USFWS Carterville Fish and Wildlife Conservation Office	Sam Finney, 9053 Route 148, Marion, IL 62959 (618) 997-6869
Rain/Sun Shelters	YES	Numerous	YES	Any	Chicago, IL	Items typcially available through OEMC	City of Chicago	Kevin Schnoes 312-744-4034
Rain/Sun Shelters	Yes	2	Yes	Any	Springfield, IL	2 canopies	USDA WS	Timothy White
Tables/Chairs	Yes	6	Yes	Any	Springfield, IL	6 chairs	USDA WS	Timothy White
Tables/Chairs	YES	2	YES	Year-Round*	Columbia, MO	1-2 tables, no chairs	USFWS, Columbia FWCO	USFWS, Columbia FWCO
Tables/Chairs	YES	Numerous	YES	Any	Chicago, IL	Items typcially available through OEMC	City of Chicago	Kevin Schnoes 312-744-4034

* Availability dependent on workload feasibility at time of request

Appendix C

Health and Safety Information

(to be included in revised plan)

Appendix D

Site Security Plan

(to be included in revised plan)

Appendix E

Notification and Contact Information

APPENDIX E

RESPONSE NOTIFICATION/LOCAL CONTACT LIST	
AGENCY/ORGANIZATION	**CONTACT PHONE NUMBERS**
Agriculture	
IL Department of Agriculture	**Office:** (217) 782-2172
IL Department of Agriculture-Bureau of Animal Health	**Office:** (217) 782-4944
US Department of Agriculture- Wildlife Services	**Office:** (217) 241-6700
US Department of Agriculture- Wildlife Services	**Office:** (301) 734-7833
Companies/Properties Along River	
Midwest Generation (Julia Wozniak, Env. Mgr)	(630) 771-7880
Will County Forest Preserve, Sugar Creek District Admin. Office	(815) 727-8700
Material Service Corporation (Lockport Marine)	(815) 838-3420
Cargill Lockport Grain Elevator, Morris Office	(815) 942-0932
Elected Officials	
Will County- County Executive (Lawrence Walsh)	**Office:** (815) 774-7480
Mayor of Joliet (Arthur Schultz)	**Office:** (815) 724-3700
Mayor of Crest Hill (Ray Soliman)	**Office:** (815) 741-5100
Mayor of Lockport (Dev Trivedi)	**Office:** (815) 838-0990
Romeoville (John Noak)	**Office:** (815) 886-7200
Emergency Management	
IEMA- Will County	**Office:** (815) 740-8351
Romeoville EMA	**Office:** (815) 886-4085
Fire Departments	
Joliet	(815) 724-3500
Crest Hill	(815) 838-3287
Lockport	(815) 838-3287
Romeoville	(815) 886-7227
Will County Health Department Staff	
Main Office	**Office:** (815) 724-8484
Environmental Health Department	**Office:** (815) 727-8490
Hospitals	
Adventist Bolingbrook Hospital (500 Remington Blvd, Bolingbrook, IL):	(630) 312-5000
Silver Cross Hospital (1200 Maple Road, Joliet, IL):	(815) 740-1100
Palos Community Hospital (12251 S. 80th Ave, Palos Heights, IL):	(708) 923-4000
Hotels	
Towpath Inn (Lockport)	(815) 838-1881
Holiday Inn (Joliet)	(877) 863-4780

APPENDIX E

RESPONSE NOTIFICATION/LOCAL CONTACT LIST	
AGENCY/ORGANIZATION	**CONTACT PHONE NUMBERS**
Super 8 (Romeoville) Best Western (Romeoville)	(630) 759-8880 (815) 372-1000
Law Enforcement Joliet Crest Hill Lockport Romeoville	 **Office:** (815) 724-3201 **Office:** (815) 741-5115 **Office:** (815) 838-2131 **Office:** (815) 886-7219
Illinois Department of Natural Resources Office of Water Resources ANS Program Manager, Steve Shults	 (312) 793-3123 (618) 435-8138
Illinois Department of Public Health Springfield Office Chicago Office	 (217) 782-4977 (312) 814-2608
Illinois Environmental Protection Agency Rob Sulski	**Office:** (217) 782-1654
Illinois State Water Survey	**Office:** (217) 333-9544
Lockport Lock and Powerhouse Lock Facility Lockmaster, Pat Carry **Powerhouse** Phil Nieman Martin Castro	 (815) 838-0536 **Cell:** (815) 530-0729 (312) 218-5984 (312) 401-9328
Media Outlets –Print Joliet Herald News Romeoville Reporter	 **Office:** (815) 439-5302 **Office:** (630) 368-1100
Metropolitan Water Reclamation District of Greater Chicago	**Office:** (312) 751-7900
Support Services SET Environmental Disposal and Cleanup, Mike Kasal	**Cell:** (847) 613-0715

APPENDIX E

RESPONSE NOTIFICATION/LOCAL CONTACT LIST	
AGENCY/ORGANIZATION	**CONTACT PHONE NUMBERS**
US Army Corps of Engineers Chicago District- Environmental Illinois Waterway Operations Chief, Mike Cox Electric Barrier System Operations, Charles Shea	 (312) 846-5330 (309) 626-4601 Ext. 210 (312) 846-5568
US Environmental Protection Agency GLNPO, Bill Bolen	**Office:** (312) 353-6316
US Fish and Wildlife Service Chicago Ecological Services Office Asian Carp Coordinator, Sam Finney Fisheries Program, Michael Hoff	 (847) 381-2253 (618) 997-6869 (612) 713-5114
US Geological Survey	**Office:** (217) 344-8747
Will/South Cook County Soil and Water Conservation District	**Office:** (815) 462-3106

Appendix F

Treatment Matrix and Elimination Criteria

APPENDIX F
TREATMENT MATRIX

Response Options	Treatment Efficacy	Rank for Use in Streams/Rivers*	Amount Required	Treatment Cost	Average Time for Complete Treatment	Staff Assets to Complete Treatment	Long Term/Environemtal Effects of Treatment	Pros	Cons
No Further Action	0%	--	None	None	None	None	None	• Non-invasive treatment	• Increase potential for fish to by-pass expand to Great Lakes
Containment/Herding/Physical Removal (Electofishing/Netting)	Variable	--	Equipment	Expensive	dependent on response location	Several Crews working multiple shifts	Minimal effects on native fish populations. Restocking is possible	• Least invasive • May garner public support.	• Need high exploitation rates • Juveniles and other game fish quickly fill void • Variable Sucess; fish escape possible • Benefits are short lived, nets must be removed for normal shipping resumation • Leaping behavior of silver carp may make removal difficult.
Rotenone	100% for post-embryonic fish in treatment area at correct dosage and time	High	>3000 gallons %5 solution (170 ppb final conc.)	5 mile strech of Lockport Pool: $665,000	4-8 hours	Chemical Treatment Crew	• Possible temporary effects on aquatic habitat and nontarget species such as newts and zooplankton • No known when used in accordance with label and proper detoxification • EPA approved for piscicide use	• US registered piscicide • Spatially selective application • Approved for large/small river systems • Post-embryonic fish control	• Temporary loss of potable water supplies and recreation opportunities • Does not kill intact fish eggs • Can be repellent • Possible permitting issues for use
Antimycin A (Fintrol)	100% post-embryonic fish in treatment area at correct dosage and time	High	110+ gals (425 units) 23% sol'n (25 ppb final conc.)	2004: $360 per unit	2-8 hours	Chemical Treatment Crew	• Possible temporary effects on aquatic habitat and nontarget species such as newts and zooplankton • Highly toxic to quail • EPA approved for piscicide use	• US registered piscicide • Nonrepellent • Post-embryonic fish control • Species selective • Prohibit public access for 7 days for complete degradation • Can be applied any time of year	• Limited availability/history • Not effective above pH 8.5 • Does not kill intact fish eggs • Temporary loss of potable water supplies and recreation opportunities • Asian carp less sensitive to effects than most species would require max allowed dose and increase time for complete action
Clove Oil	Variable	--	Unknown	Unknown	Unknown	Chemical Treatment Crew	Contains 15-20% impurities, some of which may be toxic.	• Potential natural treatment may garner public support	• Potential carcinogenic characteristics • Lethal to human cells at 3.7 g/kg body weight • Primarily used as anesthetic • Not approved for use in open water systems
Aqui-S	Variable	Medium	Unknown	Unknown	Unknown	Chemical treatment crew	No known human health concerns and this product has been approved for use in food. Minimal environmental effects- approved for use in the US.	• May be sucessful treatment	• Primarily used for fish anesthetic not piscicide • Requires high concentrations for action
Finquel (MS222)	Variable	--	Unknown	High	Unknown	Chemical treatment crew	Unknown	• May be sucessful treatment	• Primarily used for fish anesthetic not piscicide • Not approved for use in open water systems • Lack of mammalian toxicity data
Acoustic Barrier (Sonic Disruption) (Acoustic Deterrents)	~ 95%[1]	--	Single apparatus	Unknown	Unknown	Single Installation event	No known effects	• Increased effectivness at proper frequency	• Proper sound frequency delineation period for optimal deterrent • Increased efficiency when used with other methods
Bubble Barrier (Air Bubble Curtain)	Variable	--	NA	Unknown	Unknown	Single Installation event	No known effects	• Non-invasive treatment	• Fish may continue to challenge the system until eventual by-pass
Thermal Barrier	up to 100% Temperature Dependent	--	NA	Unknown	dependent on response location and amount of water to heat	Very low staff requirements	None	• Effective creation of dead zone with maintained temperature	• High risk safety hazard to persons on or near water • Difficult to ensure adequate mixing • Thermal and dissolved oxygen tolerances of Asian carp unknown
Deoxygenation (via Nitrogen, Carbon Dioxide, Sodium Sulphate)	up to 100%	--	Variable	2004 cost of $250,000/day with Nitrogen	Unknown	Low	No Known Effects when used as directed	• Minimal human health or environmental effects when used as directed	• Difficult to ensure adequate mixing • May temporariliy halt further progression, but would not address fish past deoxygenation zone
Deoxygenation via Microbes	up to 100%	--	Unknown	Unknown	Unknown	Low	No human health concerns and minimal environmental effects when used as directed.	• Potential "Green" solution may garner public support	• Potential effects on local ecosystem with introduction of new species into benthic environment
Explosives (Dynamite, Detonation Cords)	Variable	--	Unknown	Low	Immediately	Several crews to set up time explosives	Environmentally disruptive, may cause significant habitat damage and impact nontarget plant and animal species.	• Effective in small areas.	• Generally does not eliminate entire population • Could impact dams or other nearby support structure integrity; hazardous to humans and other nontarget species.
Increased River Flow	Unknown	--	NA	Low	Unknown	Few to none	May cause significant habitat damage and impact nontarget plant and animal species	• Minimal human health concerns • May be sucessful treatment	• Would require additional Lake Michigan diversion which is set by court decree • Asian carp are strong swimmers and may be attracted to flow
Dewatering/Water Fluctuation Techniques	100%	--	NA	May be low cost	Unknown	Few to none	Environmentally disruptive.	• Minimal human health concerns • May be sucessful treatment	• Water may remain in some pools and stream sections; can be detrimental to game fish.
Chlorine (Softchlor, Bleach Powder)	100% above	Low	Unknown	Unknown	Unknown	Chemical Treatment Crew	May result in the formation of low concentrations of persistent chlorinated-organics.	• Minimal human health concerns- protective clothing required during application period.	• Permitting impediments

APPENDIX F
TREATMENT MATRIX

Response Options	Treatment Efficacy	Rank for Use in Streams/Rivers*	Amount Required	Treatment Cost	Average Time for Complete Treatment	Staff Assets to Complete Treatment	Long Term/Environemtal Effects of Treatment	Pros	Cons
Lime	Unknown	Low	Unknown	Unknown	Unknown	Chemical Treatment Crew	• Damages to aquatic vegetation and animals • Waterbody will experience slow return to normal pH after treatment • Algal blooms may result unless pH managed.	• Minimal human health concerns-protective clothing required during application period.	• Permitting impediments
Ammonium Sulphate (110 mg/L) + Lime	Unknown	Medium	Unknown	Unknown	Unknown	Chemical Treatment Crew	Waterbody may experience eutrophication after treatment.	• Minimal human health concerns-protective clothing required during application period.	• Permitting impediments
Urea + Bleach	Unknown	--	Unknown	Unknown	Unknown	Chemical Treatment Crew	Urea + Bleach results in formation of chloramines and because of this it is not recommended.	• Minimal human health concerns-protective clothing required during application period.	• Permitting impediments
Saponins (Teaseed Cake, Mahua Oil)	up to 100%	High	Unknown	Variable based on saponin type	Unknown	Chemical Treatment Crew	No human or environmental health concerns noted	• Extremely toxic to fish at all levels tested • Natural treatment option	• Lack of research on lasting effects of treatment • Further research needed on mode of action and sensitivity studies • Not approved piscicide in U.S.
Pheromone Treatment	Unknown	--	Unknown	Unknown	Long-term	Low	• Needs additional research	• May affect long distance spawning migrations and in aggregating large schools of jeuveniles to aide in physical removal of the fish • "Alarm pheromones" may be used to keep the carp from migrating into new, uninhabited areas.	• Needs additional research; technology not ready for implementation • **Not a Rapid Response**; may prove effective for long term control
Biological Controls (Predators, Intraspecific Manipulation, Pathological Reactions)	Unpredictable results	--	Unknown	May be low cost	Long-term	Low	• Needs additional research	• Needs additional research	• Limited success in maintaining predator populations • Inability to control introduced species/pathogens • Methods need additional research. • **Not a Rapid Response**; may prove effective for long term control
Genetic Methods (Recombinant DNA Methods, Chromosome Set Manipulations, Ploidy Manipulations, Triploid Sterilization, Gamma Irradiation, Steroid Treatment, Chemical Treatment, Surgical Gonadectomy)	Varies by method employed	--	NA	Varies by method employed; can be reletively low cost	Long-term	Low	• Needs additional research	• Some methods ready for certain species if sterile carp introduced • Control populations through producing sterile young.	• Efficacy, strengths, and weaknesses of genetic methods for biological control of invasive fish are relatively poorly understood; • Limited research has been conducted on asian carp • **Not a Rapid Response**; may prove effective for long term control

* from Clearwater et al. 2008
[1] "Aquatic Nuisance Species: An Evaluation of Barriers for Preventing the Spread of Bighead and Silver Carp to the Great Lakes". Sea Grant 2004 Final Report

Evaluation of Treatment Options

Nine evaluation criteria were established to serve as the basis for conducting a detailed analysis of options during the feasibility study (FS) and for subsequently selecting an appropriate remedial action. The nine criteria are as follows:

- Overall protection of human health and the environment
- Compliance with applicable or relevant and appropriate requirements (ARAR)
- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, or volume
- Short-term effectiveness
- Implementability
- Cost
- State acceptance
- Community acceptance

In preparing this Asian Carp Rapid Response Plan, various options were researched and listed as potential actions to be taken. After comparing the options to the nine criteria, many of the options were deemed not viable. The table below presents each option researched and the criteria that deemed the option not viable.

Option	Viable	Criteria
No Further Action	No	• Not protective of human health and the environment
Containment/Herding/Physical Removal (Electrofishing/Netting)	Yes	
Rotenone	Yes	
Antimycin A (Fintrol)	Yes	
Clove Oil	No	• Not implementable as not approved for use in open waters
Aqui-S	No	• Not implementable as not approved for use in open waters
Finquel (MS222)	Yes	
Acoustic and Bubble Barriers with Strobe Lights	Yes	
Thermal Barrier	No	• Not protective of human health
Deoxygenation (via Nitrogen or Carbon Dioxide)	Yes	
Deoxygenation via Microbes	No	• Not effective long-term due to introduction of new species
Explosives (Dynamite, Detonation Cords)	No	• Not implementable due to possible structure damage from explosives
Increased River Flow	No	• Not implementable
Dewatering/Water Fluctuation Techniques	No	• Not protective of the environment
Chlorine (Softchlor, Bleach Powder)	No	• Not protective of the environment
Lime	No	• Not protective of the environment
Ammonium Sulphate (110 mg/L) + Lime	No	• Not protective of the environment
Urea + Bleach	No	• Not protective of the environment
Saponins (Teaseed Cake, Mahua Oil)	No	• Not implementable due to not approved for use in the U.S.
Pheromone Treatment	No	• Not implementable
Biological Controls (Predators, Intraspecific Manipulation, Pathological Reactions)	No	• No short-term or long-term effectiveness
Genetic Methods (Recombinant DNA Methods, Chromosome Set Manipulations, Ploidy Manipulations, Triploid Sterilization, Gamma Irradiation, Steroid Treatment, Chemical Treatment, Surgical Gonadectomy)	No	• No short-term or long-term effectiveness

Below are each viable option and those criteria that it meets.

- Containment/Herding/Physical Removal (Electrofishing/Netting): This option is viable because it is protective of human health and the environment, has both short- and long-term effectiveness, reduces toxicity, mobility, or volume through treatment, and can be implemented.

  Decision: Physical removal is not likely to be effective in the canal. Prior efforts to sample fish from the canal for barrier monitoring captured less than 150 fish in 2,600 hours of netting effort. The configuration of the canal and the extensive barge traffic make physical removal in that reach an unlikely option. Since effectiveness cannot be assured as a control strategy, this method was ruled-out.

- Rotenone: This option is viable because it has both short- and long-term effectiveness, reduces toxicity, mobility, or volume through treatment; and can be implemented.

  Decision: Removal of fish by use of chemical treatment with Rotenone (5% E.C.) was selected as the most viable option.

- Antimycin A: This option is viable because it has both short- and long-term effectiveness, reduces toxicity, mobility, or volume through treatment; and can be implemented.

  Decision: Although Antimycin A is toxic to the target organisms, cost and product availability preclude this from further considerations. During the toxicity testing, difficulties were discovered with maintaining target concentrations and predicted delivery for selected locations would be problematic. Additionally, this product has recently changed ownership further complicating delivery schedules, and the large quantity in stockpiles is very aged, making efficacy unpredictable. For these reasons, this method was ruled-out.

- Finquel (MS222): This option is viable because it has both short- and long-term effectiveness.

  Decision: Finquel bears future consideration for possible use in limited reaches for selective removal efforts. However, the label currently does not allow use of this drug in open water systems, or allow for discharge to natural or flowing waters. For these reasons, this method was ruled-out.

- Acoustic and Bubble Barriers with Strobe Lights: This option is viable because it is protective of human health and the environment, has both short- and long-term effectiveness, reduces toxicity, mobility, or volume through treatment, and can be implemented.

  Decision: The fish do respond to noise, light and electricity and some or many of the fish could be herded into a confinement area using this technique. But just as with explosives, it would be difficult to assure that all the fish were contained. This option is recommended for use in conjunction with other technologies as a means of reducing propagule pressure. Since effectiveness cannot be assured as a control strategy, this method was ruled-out.

- Deoxygenation via Nitrogen or Carbon Dioxide: This option is viable because it can be implemented.

  Decision: There is a supplemental aeration station about seven miles upstream of the electric barrier which is used during certain parts of the year to maintain the oxygen concentration in the Canal water. Shutting off the aerator would not reduce the oxygen sufficiently to kill fish. Further removal of oxygen could be achieved by by bubbling nitrogen gas into the water. Unfortunately, with existing technology this would be very expensive with an estimated cost of $250,000 per day for the nitrogen. This option was ruled-out.

Appendix G

Chemical Application Procedures

APPENDIX G
CHEMICAL APPLICATION PROCEDURES

Treatment Application

Eradication of finfish from the CSSC LP will be accomplished by Rotenone 5% emulsifiable concentrate (EC) and 2.5% synergized. Rotenone disperses readily in water both laterally and vertically, and will penetrate below the thermocline in thermally stratified bodies of water. The following procedure describes treatment of the lower LP as a flowing stream.

Material Delivery

Commodity materials needed for the chemical application will be delivered to the site(s) within 7 days of need for use. Site security will be provided to maintain direct control of materials by security personnel at all times until application of the chemicals are made. Bulk chemical delivery for the initial application site will facilitate the addition of piscicide to the canal. The remainder of the chemical should be delivered in 55 gallon drums to the appropriate locations. Potassium permanganate ($KMnO_4$) will be delivered in bulk by truck to facilitate ease of application of the large quantities required.

Equipment Staging

Staging for rotenone will be at Midwest Generation's Will County Station, MWRD, Material Service Corporation, or elsewhere, depending on completion of access agreements. Boats, motors, chemical application equipment, safety equipment, and vehicles for the rotenone application will be staged 1-2 days before the treatment effort. Staging for potassium permanganate will take place at the Lockport Powerhouse. Equipment will be placed into the canal the day before treatment and security will be provided on a 24 hour basis until application and recovery.

Block Nets / Final Flow Measurements

Duplicate block nets and tear-offs will be provided and installed the day prior to the rotenone application if it is determined that intakes or traveling screens at the Midwest Generation plant are in danger of being damaged by moribund fish from the rotenone application. The Eradication Supervisor and Operations Supervisor will make this determination one day before the application. If block nets are required, they will be removed as part of the cleanup operation. Final flow measurements will be obtained from the USGS gaging station in the CSSC. This flow volume will be manually verified according to standard IDNR procedure and recorded (Form 2). Total alkalinity levels will be determined by IDNR DFB one day before the treatment using Hach brand total alkalinity test kits. This value will be recorded on Form 3. Final adjustments in chemical application rates can be made at that time.

Calibration of Metering Devices

All metering devices will be calibrated onsite for rate of flow based upon 2300 cfs treatment volume. All equipment obtained for the treatment effort will be tested and proven reliable as they are acquired. All application equipment will be maintained in a "ready to go" condition by Illinois Department of Natural Resources fishery personnel.

Final calibration will be checked and adjusted if necessary based upon the verified USGS gage readings when delivered to the treatment site.

Treatment of the Lockport Pool

The following parameters were used for all calculations: canal velocity = 0.6 feet per second, length of treatment area = 5.5 miles, length of time to travel treatment area = 14.5 hours, optimal flow rate = 2,300 cfs (mean flow), time for volume change or turnover in one mile = 2.6 hours, barge repair facility (RM 295.3) = 75 acre-feet, shallow water areas = 10 acre-feet. Calculations and formulas are provided and will be verified the day of treatment using Form 3.

Treatment of the LLDP as a stream will require the establishment of five delivery system stations. The initial delivery system station will be located at CSSC river mile 297.0 which is approximately one-half mile upstream of the current electrical dispersal barrier. Four supplemental delivery system stations will be established at approximately 2-hours of travel time between each, or three-quarter mile intervals. To assure good distribution, it is necessary to apply the rotenone across the width of the channel and at multiple points throughout the water column from top to bottom. Chemical will be injected near mid-depth to accomplish adequate mixing. In addition, six-boat applicator will be required to treat the barge repair facility (Material Service Corp.) and shallow water areas via boat bailer and 1.5 inch chemical pump (for injection of chemical into deep water).

The degradation of rotenone, which influences its effectiveness, is affected primarily by water temperature, sunlight, pH, alkalinity, and suspended solids. Gilderhus et al. (1986) calculated the half-life of rotenone at 13.9h in ponds at a water temperature of 75 degrees F. An initial dose of 2.8 ppm rotenone formulation (140 µg/L Active Ingredient) is applied at the initial delivery system station. Each of the four supplemental delivery system stations will apply a supplemental dosage of 0.22 ppm rotenone formulation (11 µg/L Active Ingredient). Application from each supplemental delivery system station will begin when it is determined that treated water from an upstream station has reached the subsequent lower station. In any event, each station will begin application no more than two (2) hours following the introduction of chemical at the next immediate upstream station. Each drip station will operate for a period of eight (8) continuous hours.

Application equipment needed for the installation of the rotenone delivery system is included in Attachment 1 to this document. Each land based application site would require a crew of three, one of which would be a responder with a current aquatic applicator's license. In addition, four responders with assistance would serve as the boat applicators.

Total gallons 5% emulsifiable rotenone required: 1,823.5 gallons

Initial drip station...(2.8ppm for 8 h).....1,387 gallons
Station #2.....(0.22ppm for 8 h)..... 109 gallons
Station #3.....(0.22ppm for 8 h)..... 109 gallons
Station #4.....(0.22ppm for 8 h)..... 109 gallons
Station #5.....(0.22ppm for 8 h)..... 109 gallons

Availability of Prenfish (rotenone 5% EC) from Prentiss, Inc. will likely be within four weeks from placing the order with a confirmed purchase order number. All chemical could be delivered in 55-gallon drums.

Site and Equipment Clean-up

After the application of the rotenone and the potassium permanganate are completed, all staging and application areas will be cleaned, all containers and application gear will be removed, and containers and other refuse disposed in an approved manner.

Detoxification

Detoxification of the piscicide will be accomplished using granular potassium permanganate injected into Pit 4 at the headrace at the Lockport Powerhouse. All canal water will be directed through Pit Gates 3 and 4 at the Lockport Powerhouse before the treatment starts. This is necessary to eliminate variations in flow during the treatment. If all three pit gates are employed at full capacity, up to 7500cfs could be discharged. Under normal flow conditions (2,300cfs), it should not be necessary to use more than two of these gates. The total projected volume of rotenone to be applied is 1,823.5 gallons. At an average flow of 0.6 feet per second, the chemical plume will need 14.5 hours to travel the projected treatment area to the LL&D. Further treatment of the area by surface application will be necessary to spot-treat the barge repair facility when the chemical reaches the mouth of the facility. Spot-treatments of rotenone may also be necessary in some of the wide water areas upstream of the LL&D.

Lockport Lock

At the time rotenone is initiated, the Lockport Lock upper gate will be closed and water held at upper pool level to minimize leakage from lock. The lock will then be detoxified using 9 ppm potassium permanganate at a 200 cfs flow rate. The locks must remain closed for the duration of the treatment.

Detoxification and Chemical Rate

All flow through the CSSC will be directed through the Lockport Powerhouse at pit gates 3 and 4 before initial application of the piscicide to the treatment zone. All other bays supplying water to hydroelectric generators will be shut down prior to initiation of the treatment effort and remain closed for the duration of the project. USGS dye and fluorometers will be deployed in the canal when initial treatment is begun as a gauge to determine when detoxification should begin. Detoxification will begin when the dye is within 1500 feet of the powerhouse. The treatment at the expected average flow rate of 2,300 cfs through the powerhouse will be effected by applying permanganate as a granular or slurry directly into the pits 3 and 4 headrace access port. $KMnO_4$ will be injected at this point to facilitate complete, rapid mixing of the agent. Application of $KMnO_4$ will be done utilizing a metered auger delivery unit. Additional dye of a different color will be added when the initial drip station treatment ends to mark the extent of the treatment slug.

The 37-foot drop from the point of application to the tail-water in the upper end of BRP will provide tremendous mixing ability and should greatly aid in the detoxification process. A treatment of 9 parts per million of potassium permanganate to the 2,300 cfs of flow containing 2.8 parts per million rotenone will require 99.68 pounds of $KMnO_4$ per minute for the entire detoxification time required; approximately 10 hours. The detoxification will require up to 60,000 pounds of potassium permanganate at the Lockport Powerhouse. This amount will be dependent on the final concentration of rotenone applied and water temperature at the time of applications. Additional stocks of up to 2,000 pounds of $KMnO_4$ may be needed to treat various leaks from the canal walls into the Des Plaines River, and the Lockport
Lock. As the end of the rotenone treated slug moves downstream from the mouth of the barge repair facility, boat application of 1500 pounds of potassium permanganate will be applied to neutralize the repair slip area, keeping it from slowly leaching rotenone into the canal flow.

Equipment and Personnel
Application equipment and labor required:

1 - Small tractor (bobcat) with end loader to off-load chemical
1 - Metered conveyer to determine rate of granule application as mixed slurry or direct granular application to the headrace access ports
3 - Application boats for surface application of potassium permanganate within the lock chamber, the barge repair harbor, and to control any leakage at seeps through the canal wall along the Des Plaines River.
1 - Boat and motor to observe detoxification results downstream in the BRP, maintain live cages, and observe mortality
250 - Fiberglass mesh sand bags
8 - Sets of full Tyvek coveralls and respirators, face masks, and neoprene gloves
4 - Scoop shovels
3 - Large tarps to cover chemical and protect from moisture

The detoxification crew will consist of 10 people. Because of the labor intensive work, two complete treatment crews of 4 people each should be on hand for the duration of the detoxification effort. The two additional personnel will be responsible for noting downstream mortalities and using sand-bags containing $KMnO_4$ to detoxify any “leakers” along the Des Plaines River and Deep Run Creek.

Downstream Toxicities
$KMnO_4$ will require a contact time of at least 20 minutes to completely mix and detoxify 2.8 ppm of rotenone from the time it is added at the powerhouse. The downstream travel of this discharged water in the BRP during this period indicates that the kill zone may extend downstream from the LL&D approximately 2 miles. This location is about ½ mile upstream from the confluence of the Des Plaines River and the CSSC. Due to the application rate of potassium permanganate necessary to detoxify 2.8 ppm rotenone formulation, there is potential for additional loss of fish downstream. Since fish in BRP may be exposed to as much as 9 ppm of $KMnO_4$ for 8 -10 hours, some species may

experience mortalities further downstream. In the event of significant mortalities in BRP due to $KMnO_4$, a program to neutralize potassium permanganate using citric acid will be employed. In this instance, citric acid will be applied to the surface by boat in the Brandon Road Pool. A discussion of potassium permanganate effects and the citric acid neutralization procedure are included in Appendix K.

An observation boat will be located downstream of the Lockport Powerhouse to observe the effects of detoxification in the BRP. The observation crew will also tend live cars containing sentinel fishes to note any latent affects downstream. A direct communications link will be established between the detoxification crew and the piscicide application crew. Any necessary adjustments in application techniques will be coordinated based on reports from the observation crew.

Monitoring

Treatment monitoring and dose verification will be provided by use of chemical testing equipment and live cages with sentinel fishes. An assay to verify the detoxification procedure will also be conducted via live cages. These live cages will be constructed and deployed according to the following protocol.

Live Cage Construction

Seven floating live cages will be constructed 4' x 4' x 4' with 1" square mesh. Each of these will be suspended by use of a 4' square frame constructed of 4" diameter glued PVC and connected to a hinged lid framed of 1" diameter glued PVC. Each panel (4 sides, top, and bottom) will be constructed of 1 inch mesh 16-gauge PVC coated wire. The bottom will be reinforced by a glued frame constructed of 1" diameter perforated PVC. Five of these live cages are required for treatment verification, and two will be used to monitor the detoxification in BRP.

Two sunken live cages will be constructed 2' in diameter by 2' long using 1" square mesh 16-guage PVC coated wire. Each cylinder will be supported by three galvanized steel hoops. Lead anchor weights will be added sufficient to maintain contact with the bottom of the canal. A poly rope and 9" buoy will be connected to these cages to assist with deployment and recovery.

Live Cage Deployment

To verify treatment effectiveness against the target fishes, nine stations of live cages containing common carp as sentinel fishes will be deployed and continuously monitored. Common carp will be used as sentinel fishes as their sensitivity to rotenone lies between that of silver carp and bighead carp. There will be seven floating live cages and two sunken cages. Each floating live cage will contain 10 common carp obtained by electrofishing devices from the Illinois River. The two sunken cages will contain 3 common carp each.

Three live cages will be located at the upstream end of the treatment area, just below the electric barrier. Two floating live cages will be deployed on the stream edge and secured by ropes. One sunken live cage will be placed on the bottom at midstream and anchored.

This arrangement will be repeated at the lower extremity of the treatment area, just upstream of the LL&D. Another floating live cage will be placed midway through the treatment reach across from the grain elevator at RM 293.5.

The remaining two floating live cages will be placed in BRP to verify detoxification. These floating cages will contain 5 common carp. The first will be deployed approximately 3000 ft. downstream of the LL&D to determine effectiveness of detoxification. The final floating live cage will be deployed at RM 289.8, just downstream of the confluence of the CSSC and Des Plaines River. If necessary, fishes killed in the detoxification monitoring will be removed and replaced with healthy fishes held on 1000 gallon hatchery stocking trucks. Organisms killed in the treatment zone will not be replaced.

Examination and Records

The condition of fish in live cages will be monitored continuously. Fish which have lost upright swimming and /or respond to gentle prodding will be classified as lethargic. Any fish which have ceased opercular movement or appear moribund will be prodded to stimulate movement. If NO active movement occurs, these fish will be noted as moribund. Fish appearing moribund will be removed and a necropsy performed immediately. Mortality will be defined as cessation of heart rhythm determined by visual inspection upon necropsy. Any fish experiencing mortality will be removed and added to the disposal containers.

Detailed records will be kept on Form 4a or Form 4b for each live cage, including number of fish, species, and time to lethargy, morbidity, and mortality. These records will be compiled and summarized in a report by the Monitoring and Safety Supervisor, and submitted to the Eradication Supervisor in accordance with Section 13.

Equipment List

7 - 4 foot floating live cages:
- Each cage will need:
  - 4" PVC - 16 feet
  - 1" PVC - 32 feet
  - 90 degree PVC fittings - 4" - 4
  - 90 degree PVC fittings - 1" - 8
  - 6 - 4' sides (1" mesh 16-gauge PVC coated wire) - 24'
  - Cable ties 48
  - Rope 75 feet

2 - 2 foot sunken live cages:
- Each cage will need:
  - 1- 1" mesh 16-gauge PVC coated wire 6' x 2' = 12 square feet
  - Two ends 2' x 2' PVC coated wire = 8 square feet
  - Galvanized steel hoops 3 each
  - Cable ties 20
  - Rope 75 feet

Sentinel Fishes:
- Common Carp - 100

Fish Removal and Disposal

Generally, waters are treated with piscicides in late summer or fall so that dead fish are not a health threat or environmental hazard. While most state's current policies are to leave dead fish in the treated waters, concerns of fish clogging various intakes and screens can become serious in a highly industrialized waterway. Therefore, IDNR personnel and cooperators will conduct dead fish recovery.

To accomplish this task, 20 boats with 2-man crews will patrol the waterway to manually collect fish carcasses. The collection effort will begin immediately upon treatment and concentrate downstream as time lapses, continuing for three days during daylight hours. Each boat will have four 55-gallon drums with tops removed to contain dead fish. When filled, barrels will be delivered to land-based collection points and emptied into large dumpsters. On day 1, four land-based collection stations will be utilized, three stations on day 2, and two on day 3. These stations will be located at RM 295.5 (Midwest Generation, day 1 only), and along the east bank at CSSC RM 291.4, RM 292.2, and RM 293.4 (days 1 and 2 only).

The biomass estimate of fish in the treatment area is 200,000 pounds (Appendix J). This estimate concurs with data provided by MWRD and Midwest Generation. Therefore, multiple dumpsters suitable for holding a total of 200-300,000 pounds of dead fish will be required; two at each collection point, and two in reserve. Equipment needs and cleanup operations will completed by sub-contractor.

Project personnel will be required to assist with attachment / detachment of equipment at the land-based collection locations. One person at each land-based collection location will be supplied with recording forms (Form 5) to record the number of barrels collected, location of collection, and special notes of interest (i.e., number of target species collected). These data will be forwarded to the Operations Supervisor when the collection effort is complete. The Operations Supervisor will provide a report estimating the species, biomass, and location of fish killed in the eradication effort. This report will be forwarded with other reports to the Eradication Supervisor.

After project completion, waste containers will be removed and emptied into a suitably permitted disposal location by the contractor (currently Environmental Recycling and Disposal, Joliet, IL). **Dead fish are not to be offered for human or animal consumption.**

ATTACHMENT 1
ROTENONE DELIVERY SYSTEM
DESIGN AND OPERATING PROCEDURES

The rotenone delivery system will eradicate Asian Carp from the Chicago Ship and Sanitary Canal (CSSC) between the aerial pipeline at river mile 296.7 (upstream of existing electric dispersal barrier) and the Lockport Lock and Dam at river mile 291.1. Eradication of finfish from the CSSC will be accomplished by injecting Rotenone (5% emulsifiable concentrate) in the canal below the water surface. The following procedure describes the design and operating procedures of the rotenone delivery system.

1.0 Design Requirements and Volumes

Requirements

The following requirements were considered in the design of the rotenone delivery system.

- Five stations will be located throughout the length of the treatment area (5.5 miles) with the initial application at river mile 296.7
- Initial application should have a 5% rotenone formulation of 140 ppb active ingredient
- Other four applications should have a 5% Rotenone formulation of 11 ppb active ingredient
- The rotenone delivery system will operate for 8 continuous hours
- The river optimal flow rate is 2,300 cfs and up to 2,500 cfs.

Application Volume

Based on the above design requirements, the total volume of 5% emulsifiable rotenone required is 1,823.5 gallons. The table below shows a break down of the volumes and concentrations at each station.

Station	Concentration (ppm)	Undiluted Rate (gpm)	Undiluted Volume (gallons)	Diluted Rate (gpm)	Max. Diluted Rate (gpm)
Initial station, river mile 296.7	2.80	2.9	1,387	29	31
Station #2	0.22	0.2	109	2.3	2.5
Station #3	0.22	0.2	109	2.3	2.5
Station #4	0.22	0.2	109	2.3	2.5
Station #5	0.22	0.2	109	2.3	2.5

The volumes and application rates are based on a river optimal flow rate of 2,300 cfs, except the maximum diluted rate which assumes a river flow rate of 2,500 cfs.

2.0 Land Side Equipment Construction

The land side equipment construction includes all the piping, tanks, and pumping system required to inject rotenone in the river at the rates specified by IDNR. Two different types of systems will be installed according to the required chemical application volume. The two system types are described below

1. Rotenone delivery system for 30 gpm application rate. One location upstream of the existing aerial piping was identified for this initial application rate.
2. Rotenone delivery system for 2.5 gpm application rate. Four locations between the initial application rate and the Lockport lock and dam will be identified for this application rate.

<u>Rotenone Dilution Methods</u>

The rotenone must be diluted to 10 percent of its original strength prior to injection. The dilution method will depend on the type of rotenone delivery system as described below.

Diluting the rotenone for the 30 gpm application rate system will be accomplished by premixing it in 3 rented 4,900-gallon polyethylene tanks prior to injection. Premixing will eliminate the need to field measure the inline mix to accomplish the correct concentration. A 4-inch contractor trash pump or smaller pump with poly chemical camlock hose will be used to pump the correct rotenone volume into the 4,900-gallon tanks from 55 gallon drums of rotenone. The 4-inch contractor trash pump with 4-inch nitrile heavy duty camlock hose will also be used to pump water from the river into the 4,900-gallon mixing tanks for dilution. Marks will be made on the tank walls to determine the correct volumes to be pumped in order to reach a 10-percent dilution. The rotenone pumping system, described below, will be attached to one of the 4,900-gallon mixing tank. Therefore, the diluted rotenone from the other two mixing tanks will be transfer to this 4,900-gallon mixing tank with the 4-inch contractor trash pump. Approximately twenty five 55-gallon rotenone drums will be needed for the mixing at the initial application. The drums will be staged at the site over a plastic mat that provides spill containment. According to IDNR, secondary containment is not required once the rotenone is mixed, so no secondary containment is included under the polyethylene tanks.

Diluting the rotenone for the 2.5 gpm application rate system will be accomplished by inline mixing because, according to the IDNR, the injected concentration is less critical at the downstream stations. A 3/4-inch electric diaphragm pump with ¾” hose and T fitting will be used to pump the 55 gallon drum of rotenone and water from the river. A gate valve to regulate flow will be installed between the 55-gallon drum and the T fitting. Two 55-gallon rotenone drums will be needed for the mixing at each of the four 2.5 gpm application locations. The drums will be staged at the site over a plastic mat that provides spill containment. Prior to the injection event, the correct settings for the rotenone valve will be established by using a one or two gallon container of water to determine the injection rate. This will be accomplished by observing the extraction of a

certain volume of material from the smaller container over time and adjusting the valve until the correct mixture is achieved.

Rotenone Pumping System

The pumping system for the 30 gpm application consists of a combination of air-powered diaphragm pump and valves to transfer the diluted rotenone from the 4,900-gallon tank to the perforated HDPE pipeline for injection into the river. A 3-inch valve is located at the drain of the 4,900-gallon tank to shut the tank. The intake hose from a 2-inch diaphragm pump is connected to the tank drain. The 2-inch diaphragm pump is air-powered and requires a compressor that can be fuel or gas powered. A ball valve, reducers and a flow meter will be added to the discharge line. The ball valve should be located about 5 feet from the flow meter. Reducers, 2" x 1 ½", will be located before and after the flow meter. Standard fittings and adapters will be use to connect the valves, reducers and hoses. The flow meter and reducers could be removed if the strokes at the diaphragm pump are counted to measure the volume pumped. The 2" diaphragm pump will deliver 0.7 gallons per stroke. (Varies with different pumps and the volume of the specific pump should be verified). The discharge line is a 2-inch nitrile heavy duty camlock hose and will be connected to the HDPE pipeline. The connection between the nitrile line and HPDE line will be made using a Fernco flexible coupling about 5 feet away from the flow meter. The HDPE pipeline is 150 feet long and will be perforated (drilled) with 38 orifices, 7/64-inch in diameter, spaced every 4 feet.

The pumping system for each of the 2.5 gpm application consists of a combination of electrical diaphragm pump, T fittings and valves to perform inline mixing of Rotenone and river water and pump the diluted Rotenone through the perforated HDPE pipeline for injection into the river. A gate valve will be placed in the intake line between the rotenone drum and the river water intake line. One end of the intake line will be connected to a T fitting at the river water intake (suction) line and the other will be placed in the rotenone drum. Rotenone will be drawn into the pump along with river water mixed by the pump before injection into the river. This will require making measurements in the field to ensure that the mixture is correct. A ball valve, reducers and a flow meter will be added to the discharge line. The flow meter and reducers could be removed if the strokes at the diaphragm pump are counted to measure the volume pumped. The discharge line is a 3/4-inch nitrile heavy duty camlock hose and will be connected to the HDPE pipeline. The connection between the nitrile line and HPDE line will be made using a Fernco flexible coupling about 5 feet away from the flow meter. If Fernco flexible coupling is not available in ¾-inch, an insert fitting with male/female thread could be used for the connection. The HDPE pipeline is 150 feet long and will be perforated with 15 orifices, 1/16-inch in diameter, spaced every 10 feet.

3.0 Water Side Equipment Construction

Once the land side equipment is assembled, the HDPE can be pulled across the water surface at each injection location. Either prior to or as the pipe is being installed the orifice holes should be drilled at the spaces indicated for each type of system. The pipe has a specific gravity of approximately 0.96, so the pipe should float. The HDPE pipe comes in 200-foot rolls. One end of the pipe will have a welded HDPE cap or blind flange to seal it off, but the line should fill with water through the orifice holes, which will make it less buoyant so that the weights can pull it under the water surface. The other end of the pipe can be cut as needed for connection to the land-side piping. Once the pipe is fully extended across the canal, the HDPE pipe can be attached to weights to submerge the pipe approximately 10 feet below the surface. The weighted float system will consist of a 30 pound weight, a nylon rope, and a float.

Weighted Float System Construction

The weight will be approximately 30 pounds, which should allow handling by a single person on the watercraft. This design identifies two weights that can be used on this project. A 30-pound river anchor can be purchased through a local marine equipment distributor. The cost for each anchor is approximately $50. An alternative would be to make a weight using a 5 gallon paint bucket, cement, and a 12-inch anchor bolt. This material is readily available at large hardware retailers, such as Home Depot or Menards, for less than $10. The alternative weights would need to be made 2-3 days prior to placement in the river to allow the anchor bolt to harden in the cement. Approximately 2 gallons of cement would be needed in each bucket.

The nylon rope would be a minimum of 25 feet in length. One end is tied to the weight and the other to the float. A loop will be tied in the rope 15 feet above the weight. The HDPE pipe will be attached to this loop, as discussed in the next section.

The float serves two purposes. One is to allow the location of the subsurface pipe to be identified from the surface. The second purpose is to allow retrieval of the weight and HDPE pipe. For the purpose of this design, boat fenders 6 inches in diameter and 18 inches long are identified. These cost approximately $12/each. Because the HDPE pipe is slightly buoyant, the float is not need to suspend the pipe. More economical alternatives to the boat fender may be used as long as they are visible from the bank and allow recovery of the weight and pipe.

A minimum of six weighted floats will be required for the 2-inch HDPE pipe at the main injection location and four weights floats will be needed at each booster location. The weighted floats should be spaced evenly across the canal. Several extra anchors and floats should be prepared as backups/additional weights in the event that the current requires more than is currently contemplated.

Pipe Attachment

With the pipe fully extended across the canal, the weighted floats will be attached to pipe to pull the pipe below the surface. The pipe can be attached to the weighted floats in several ways. One method is to attach the pipe with a short rope to the loop and lower the weight and pipe at the same time. This is the most expedient method, but may complicate subsequent attachments as the pipe is drawn under water.

A second method would be to tie a 25 foot long rope to the pipe at each float location, run the rope through the loop and then tie attached the rope to the float. After the pipe is tied to the float, the weighted float can be lowered with the pipe continuing to float on the surface. Once all of the weighted floats are placed in the canal, the rope attached to the pipe can be untied at the float and pulled, drawing the pipe underwater. When the pipe is flush against the loop, the rope can be re-attached to the float. The force used to pull the pipe underwater may temporarily draw the weight off the canal bottom.

With all of the weighted floats in place and the application pipe submerged below the surface, a final rope will be attached to the float closest to the pipe tail. The other end of this rope should be attached to a manmade or natural object on the bank closet to the tail to prevent this end of the pipe from wandering during the Rotenone injection.

Pipe Recovery

Once Rotenone injection is complete, the system can be recovered from the river. From the watercraft, grab the float and pull the weight to the surface, bringing the pipe up at the same time. The pipe can be either separated from the weighted float and allowed to float freely, or size reduced and placed in the water craft. If allowed to float freely the pipe will be pulled to the shore in a single piece.

4.0 Equipment List

The following equipment and sources will be needed for the installation of the rotenone delivery system.

West Mariner (westmarine.com)

30lb. River Anchor	$49.99 USD
1/2" Mega Plait Nylon Line, 7500lb. Breaking Strength	$0.93 USD

Jim Buoy (jimbuoy.com)

Model #	Size	Hole Size	Vessel Size	Pack	Ship Wt.
Boat Fenders - 706	6" dia x 18"	5/8"	up to 28'	6	21 lbs.

The Home Depot

5-Gal Orange Paint Bucket – Model 05GLH2 ($2.34/ea)
12-inch eye bolt – approximately $4.00

Rain for Rent (rainforrent.coom)

Rental Items

Qty	Duration (days)	Item	Description	Day	Subtotal
3	2	+660506	4,900 Gallon Poly Tank	$ 24.00	$ 144.00
1	2	+670506	10ft x 18ft x 8" Spillguard Containment Berm	$ 25.00	$ 50.00
1	2	+811072	2" Air-Operated Poly Diaphragm Pump	$ 60.00	$ 120.00
4	2	720018	2ft x 2ft Spillguard Containment Berm	$ 7.00	$ 56.00
1	2	RRC	Air Compressor for Diaphragm Pumps	$ 145.00	$ 290.00
2	2	723109	2" x 5ft Nitrile Heavy Duty Camlock Hose	$ 10.00	$ 40.00
1	2	+810515	4" Multiquip Trash Pump	$ 65.00	$ 130.00
66	2	MRC	All Misc Fittings and Adapters (Aproximate part count = 66)	$ 0.60	$ 79.20
5	2	726617	2" Ball Valve	$ 12.00	$ 120.00
1	2	MRC	2" Check Valve	$ 25.00	$ 50.00
2	2	723465	2" x 25ft Nitrile Heavy Duty Camlock Hose	$ 25.00	$ 100.00
2	2	723224	2" x 25ft Poly Chemical Camlock Hose	$ 25.00	$ 100.00
2	2	722880	4" x 25ft Nitrile Heavy Duty Camlock Hose	$ 15.00	$ 60.00
					$ 1,339.20

Sale Items

Qty	Description	Unit Price	Subtotal
4	Omega FL-510 Flow Meter1 to 10gpm	$279.23	$1,116.92
1	Omega FL-75F Flow Meter 4 to 40gpm	$413.85	$413.85
200	2" HDPE SDR11 Pipe	$0.67	$670.00
1	2" Fernco double coupling		
1	2" HDPE End Cap	$10.32	$51.60
800	3/4" HDPE SDR11 Pipe		
1	3/4" Fernco double coupling		
1	3/4" HDPE End Cap		

Installation of Land Side Equipment (p

Est. Delivery Hauling	$810.00
Est. Pick-up Hauling	$810.00
Est. Install Labor	$3,735.00
Est. Removal Labor	$1,560.00
Est. Appl Design Services	$500.00
Est. Fuel Surcharge	$210.60
	$7,625.60

FORM 1: LENGTH BY WEIGHT DATA

Body of Water	Date	Station	Sample Code	Gear	Page #
_____	__/__/__	_____	_____	_____	___ of ___

Bighead Carp

TL (mm)	Wt (g)	Age Code

Form 2

FDM 6220(modified)

VELOCITY AND FLOW

Surface velocity (ft./sec.)

Measure a minimum of 100 feet in a straight section of the stream where there are few, if any, obstructions to the current. Drop a float into the water above the upper limit of the section and time its run in seconds through the test section. The length in feet divided by the number of seconds gives the surface velocity in feet per second. An average of three trials should be used.

Volume of flow:

Volume of flow may be determined as follows:

$$R = W \times D \times (V \times a)$$

R = rate of flow in cubic feet per second (CFS)
W = average width of channel section tested in feet
D = average depth in feet
a = constant (see below)
V = surface velocity in ft./sec.

The constant (a) in the formula should be as follows: If the bottom of the channel is rough and composed of loose rocks and coarse gravel the value will be 0.8. If the bottom is smooth and is composed of such material as mud, sand, hardpan or bedrock, the value will be 0.9.

OBSERVATIONS:

Times: Trial #1 = _____sec.

Trial #2 = _____sec.

Trial #3 = _____sec.

Average Time = _____sec.

V = 100 ft. / Avg. Time = _____ft. / sec.

W = _____ft

D = _____ft

a = _____

R = W x D x (V x a) = _____cfs.

Times and calculations performed on ___/_____/_____ by_____
Date Signature

Form 3

Alkalinity, Formulas, and Conversions used for Calculations

Total Alkalinity (as ppm $CaCO_3$)**:** **Alkalinity = _____ppm**

Calculation of Application Rate for flowing waters:

X = F(1.699 B) **X = _____cfs**

X = cc per minute of rotenone applied to canal
F = the flow rate (cfs)
B = parts per million desired concentration of 5% rotenone = 3.4ppm - initial
0.34ppm - boosters

Total Amount of Rotenone Needed for Each Station:

Y = X(0.0158 C) **Y = _____gal.**

Y = gallons of rotenone required for the canal treatment
X = cc per minute of rotenone to be applied
C = time in hours of the canal treatment

Complete volume turnover of water between drip stations:

X = Volume ft^3 / D ft^3 per hour **X = _____hrs.**

X = One complete volume change (turnover) in hours
Volume ft^3 = (A)(B)(C)
A = Stream stretch between two drip stations = 1 mile or 5,280 feet
B = Width of canal = 210 feet
C = Average depth = 25 feet
D = Water flow per hour = _____cfs x 3600 seconds (1 hour) - ***Use number from Form 2.***

141 surface acres = 5.5 miles (29,040 feet) by 210 feet average width
2.7 pints per acre-foot of undiluted rotenone formulation = 1.0ppm
29.57cc = 1 fluid ounce
128 fluid ounces = 1 gallon
Three-quarter mile = 3,960 feet
480 minutes = 8 hours

Calculations performed on ___/_____/_____ by_____
Date Signature

Form 4a: Treatment Area

Sentinel Fish Observation Form

DATE_____

CAGE LOCATION_____ # _____

Observations:

			TIME OF ONSET		
SPECIES	**#**	**SIZE**	**LETHARGY**	**MORBIDITY**	**MORTALITY**
Common Carp	1				
	2				
	3				
	4				
	5				
	6				
	7				
	8				
	9				
	10				

NOTE: All times are to be recorded in standard military time (24-hr clock).
These times will be converted to actual duration times in the summary report.

Additional Notes:

Observer's signature: _____

Form 4b: Detoxification Area

Sentinel Fish Observation Form

DATE_____

CAGE LOCATION_____ # _____

Observations:

			TIME OF ONSET		
SPECIES	**#**	**SIZE**	**LETHARGY**	**MORBIDITY**	**MORTALITY**
Bluegill	1				
	2				
	3				
	4				
	5				
Channel Catfish	1				
	2				
	3				
	4				
	5				
Common Carp	1				
	2				
	3				
	4				
	5				

NOTE: All times are to be recorded in standard military time (24-hr clock).
These times will be converted to actual duration times in the summary report.

Additional Notes:

Observer's signature: _____

Form 5

Fish Collection and Disposal Form

Collection Location _____ Date _____/_____/_____

Directions: Place a tally mark in the box for each barrel collected into the dump containers. Also, place a tally mark in the bottom boxes for each target organism observed.

Full Barrels	**2/3 Barrels**	**1/3 Barrels**
total number _____	total number _____	total number _____
TARGET ORGANISMS		
Silver Carp:	**Bighead Carp:**	**Other:**
total: _____	total: _____	total: _____

Total number of barrels for station = Full barrels + (0.66 x 2/3 barrels) + (0.33 x 1/3 barrels)

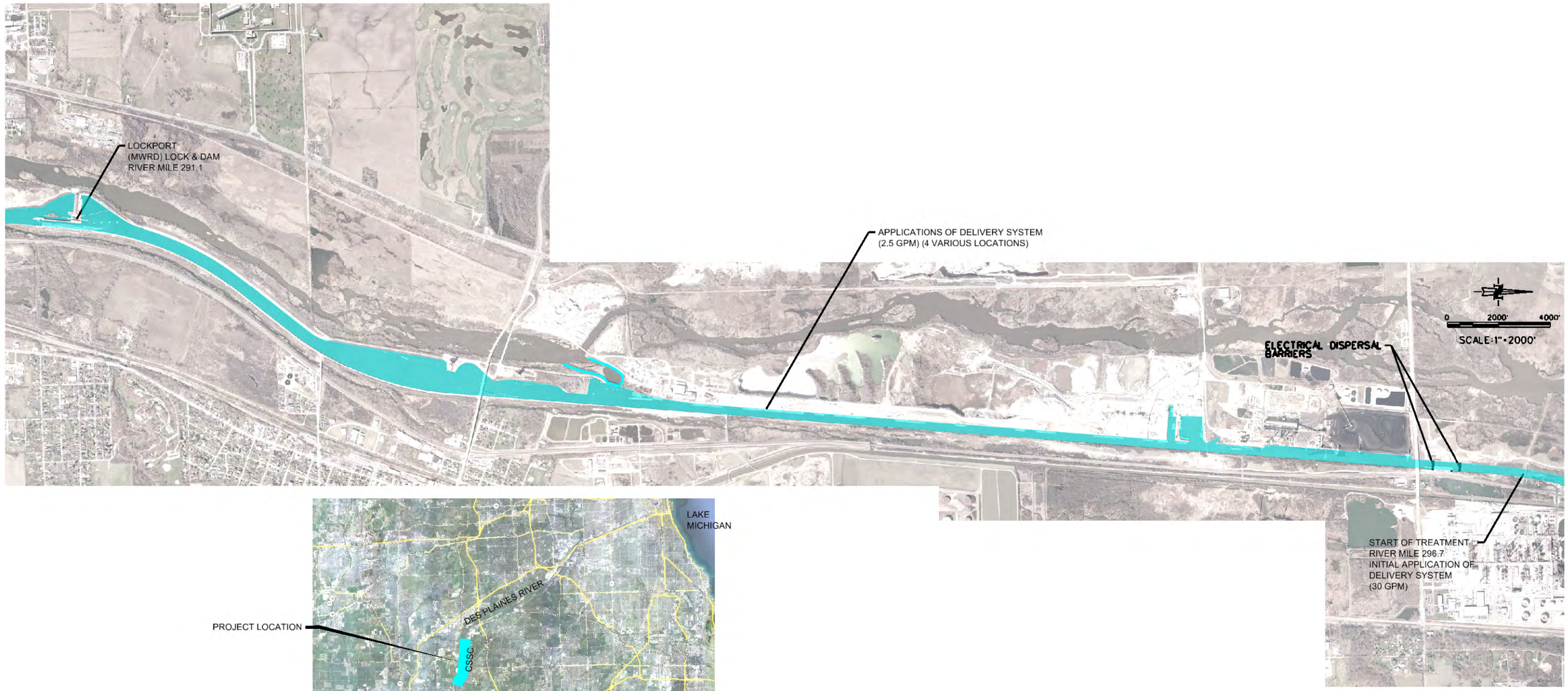
_____ + (0.66 x _____) + (0.33 x _____) = _____

NOTES:

Observer's signature: _____

GREAT LAKES NATIONAL PROGRAM OFFICE
ASIAN CARP RAPID RESPONSE

ROTENONE DELIVERY SYSTEM



G:\G1375013\DGNC-CS01.dgn kurt.vdejts 11/02/2009 4:21:19 PM

REVISIONS		
NO.	DATE	DESCRIPTION

DESIGNED TP
DRAWN KFV
CHECKED JW
DATE 11/02/2009

PREPARED BY: SulTRAC

NORTH

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
GREAT LAKES NATIONAL PROGRAM OFFICE
ASIAN CARP RAPID RESPONSE
LOCKPORT, ILLINOIS

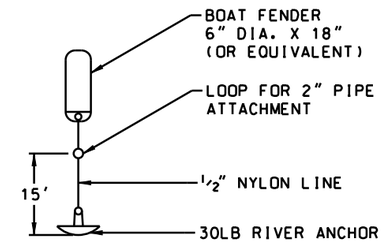
VERIFY SCALE
BAR IS ONE (1) INCH ON ORIGINAL DRAWING.
0
IF NOT ONE (1) INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

SCALES:
HORIZONTAL SCALE: AS SHOWN
VERTICAL SCALE: AS SHOWN

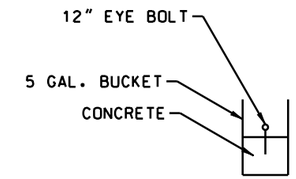
ASIAN CARP RAPID RESPONSE
ROTENONE DELIVERY SYSTEM

PROJECT NO. 103DG1375013
DRAWING NO. CS01
SHEET NO. 1 of 4

PLAN VIEW

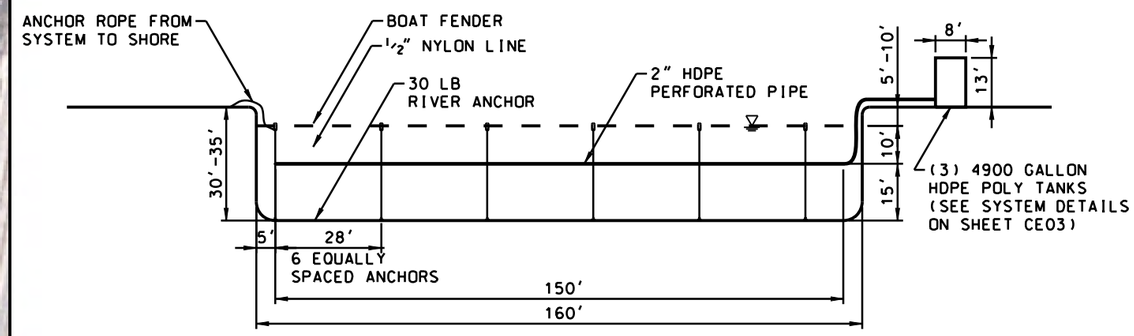


ANCHOR SYSTEM



OPTIONAL ANCHOR - HALF FILLED CONCRETE
5 GAL BUCKET AND INSTALLED 12" EYE BOLT.

OPTIONAL ANCHOR



PROFILE

REVISIONS		
NO.	DATE	DESCRIPTION

DESIGNED TP
DRAWN KFV
CHECKED JW
DATE 10/30/2009

PREPARED BY: ST SulTRAC

NORTH

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
GREAT LAKES NATIONAL PROGRAM OFFICE
ASIAN CARP RAPID RESPONSE
LOCKPORT, ILLINOIS

VERIFY SCALE
BAR IS ONE (1) INCH ON ORIGINAL DRAWING.
0 40'
IF NOT ONE (1) INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

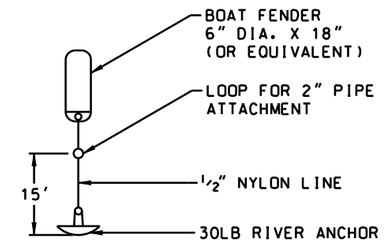
SCALES:
HORIZONTAL SCALE: 1"=40'
VERTICAL SCALE: 1"=20'

ASIAN CARP RAPID RESPONSE
ROTENONE DELIVERY SYSTEM
30 GPM APPLICATION

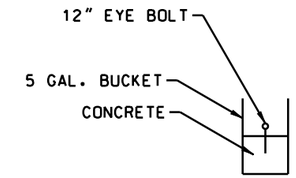
PROJECT NO. 103DG1375013
DRAWING NO. CE01
SHEET NO. 2 of 4

G:\0137\9013\DGN\CE01.dgn kurt.volpis 10/30/2009 3:58:14 PM

PLAN VIEW

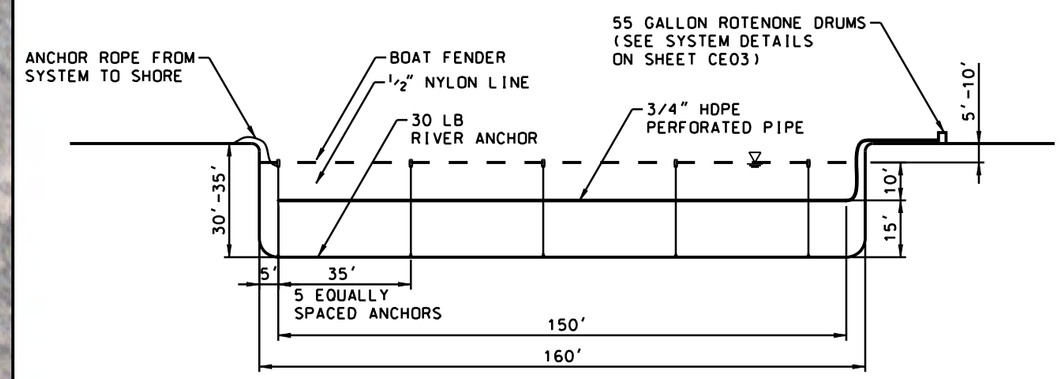


ANCHOR SYSTEM



OPTIONAL ANCHOR - HALF FILLED CONCRETE
5 GAL BUCKET AND INSTALLED 12" EYE BOLT.

OPTIONAL ANCHOR



NOTE:
OPTIONAL ANCHOR - HALF FILLED CONCRETE 5 GAL BUCKET AND INSTALLED 12" EYE BOLT.

PROFILE

REVISIONS		
NO.	DATE	DESCRIPTION

DESIGNED TP
DRAWN KFV
CHECKED JW
DATE 10/30/2009

PREPARED BY: SulTRAC

NORTH

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
GREAT LAKES NATIONAL PROGRAM OFFICE
ASIAN CARP RAPID RESPONSE
LOCKPORT, ILLINOIS

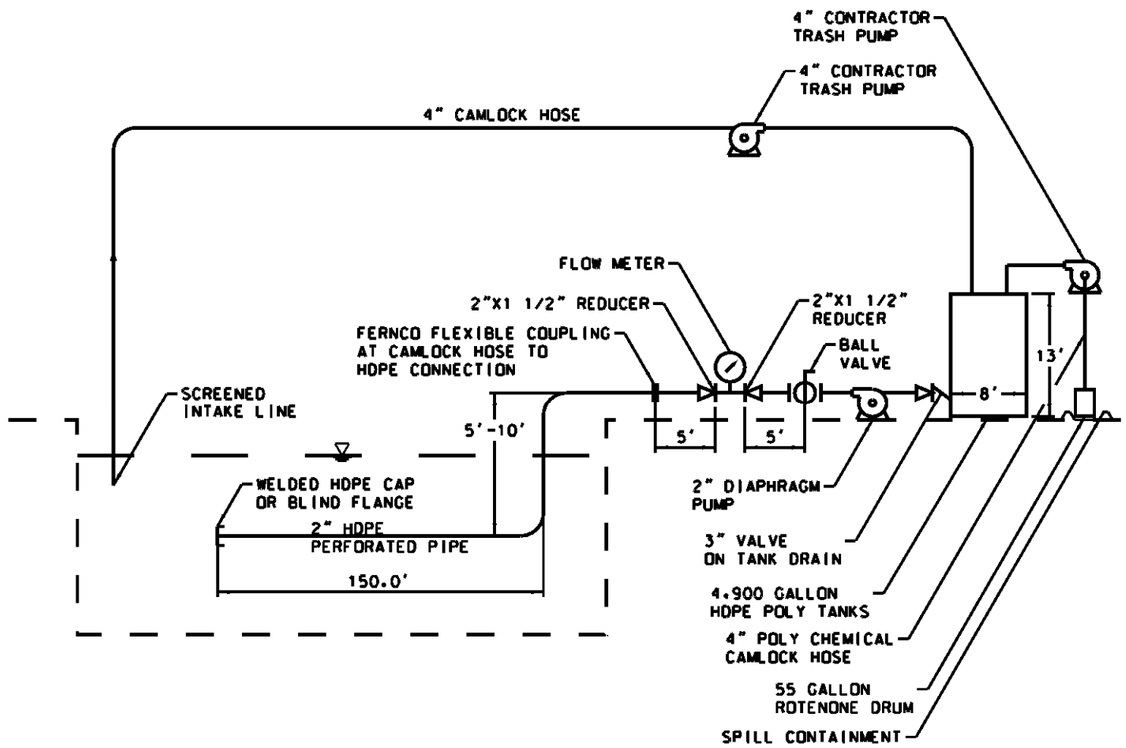
VERIFY SCALE
BAR IS ONE (1) INCH ON ORIGINAL DRAWING.
0 40'
IF NOT ONE (1) INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

SCALES:
HORIZONTAL SCALE: 1"=40'
VERTICAL SCALE: AS SHOWN

ASIAN CARP RAPID RESPONSE
ROTENONE DELIVERY SYSTEM
2.5 GPM APPLICATION

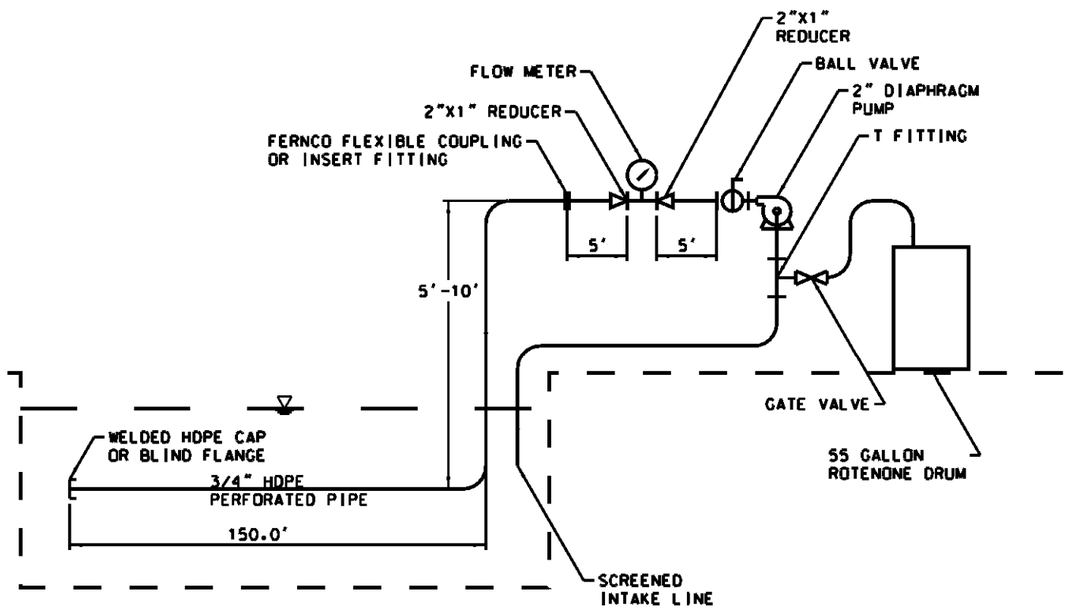
PROJECT NO. 103DG1375013
DRAWING NO. CE02
SHEET NO. 3 of 4

G:\G1375013\DGN\CE02.dgn kurt.volpis 10/30/2009 4:01:29 PM



NOTE:
1. SUPPORT PIPING AS REQUIRED.
2. HDPE PIPE PERFORATIONS ARE 7/64" AND SPACED EVERY 4' (38 ORIFICES)

30 GPM DELIVERY SYSTEM
PROCESS FLOW DIAGRAM



NOTE:
1. SUPPORT PIPING AS REQUIRED.
2. HDPE PIPE PERFORATIONS ARE 1/16" AND SPACED EVERY 10' (15 ORIFICES)

2.5 GPM DELIVERY SYSTEM
PROCESS FLOW DIAGRAM

G:\G1\1375013\DGN\CE03.dgn kurt.voigts 11/02/2009 4:49:40 PM

REVISIONS		
NO.	DATE	DESCRIPTION

DESIGNED TP
DRAWN KFV
CHECKED JW
DATE 11/02/2009

PREPARED BY: ST SulTRAC

NORTH

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
GREAT LAKES NATIONAL PROGRAM OFFICE
ASIAN CARP RAPID RESPONSE
LOCKPORT, ILLINOIS

VERIFY SCALE
BAR IS ONE (1) INCH ON ORIGINAL DRAWING.
0
IF NOT ONE (1) INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

SCALES:
HORIZONTAL SCALE: N/A
VERTICAL SCALE: AS SHOWN

ASIAN CARP RAPID RESPONSE
ROTENONE DELIVERY SYSTEM
PROCESS FLOW DIAGRAMS

PROJECT NO. 103DG1375013
DRAWING NO. CE03
SHEET NO. 4 of 4

Appendix H

Regulatory Requirements and Agency Permitting

Appendix H

Emergency Exemptions Under Section 18 of the Federal Insecticide Fungicide and Rodenticide Act

Instructions for Submission of Emergency Exemption Applications

I. General Instructions

An emergency exemption for registration may be considered for situations in which an emergency condition exists. An emergency condition exists only when the situation is urgent and non-routine and all three of the following conditions are met: (1) No effective registered pesticide is available, (2) no economically or environmentally feasible alternative practice are available, and (3) the situation involves the introduction of a new pest or will present significant risks to human health or the environment or will cause significant economic losses.

Requests for Section 18 emergency exemption use are normally compiled and submitted to EPA by the appropriate Federal or State lead pesticide agency. Registrants of pesticide products often provide key information for the request, but the emergency must be the result of and driven by actual field conditions. Requests for emergency exemption cannot be submitted by a registrant.

A. Re-certification of Repeat Specific Exemption Request

EPA allows submission of an abbreviated application for repeat specific exempt request, when EPA determines that a repeat Section 18 request is eligible for re-certification by the requesting state. The application must certify to their state department that the emergency continues to exist and that the use parameters and previously submitted information remains unchanged from the previous year. Eligibility requirements for re-certification are as follows:

- EPA granted the same specific emergency exemption (to the same applicant) the previous year.
- The emergency situation can reasonably be expected to continue for longer than one year, such as emergency conditions resulting from loss of a previously relied-upon pesticide or documented pest resistance development. Situations which would not be expected to continue include more temporary pest emergencies such as a temporary supply problem of a registered product, an isolated weather event, or a sporadic pest outbreak.
- The request is not for a new chemical, first food use, a chemical under Special Review, or for cancelled or suspended chemicals, including those voluntarily cancelled by the registrant. These requests warrant heightened review and also enhanced public involvement and transparency.

Additionally, EPA may declare any repeat exemption ineligible to use a streamlined re-certification application at any time, and will do so when EPA concludes that an updated application would be appropriate.

If EPA determines that a repeat Section 18 request is eligible for re-certification, then the Federal or State lead pesticide agency will need to submit a letter or email certifying the following:

- The emergency condition still exist,
- The information is still accurate,
- The conditions of use are identical,

- Any conditions or limitations from previous exemptions are satisfied, and
- There are no new alternative control measures that are effective.

Although EPA expects to accept a valid re-certification application as sufficient basis for the requestor to rely on previously submitted data to characterize the pest problem, the EPA will continue to evaluate and consider whether the criteria necessary for granting an exemption has been met. In particular, EPA will independently evaluate whether any alternative control materials or measures have become available, whether the health and environmental risk assessment remain valid, and whether adequate progress toward registration of the use is being made. The Federal or State lead pesticide agency will provide complete documentation of any changes from previously submitted data, especially any new control material or methods. If a re-certification application requests a change in any of the use parameters, EPA may need to conduct a revised risk assessment. Changes in any of these criteria may impact EPA review time and regulatory outcome.

If an exemption is not classified as a candidate for re-certification by EPA, the Federal or State lead pesticide agency must submit a conventional emergency exemption application that contains all of the information outlined in 40 CFR 166.20. Eligibility to use a re-certification application will be communicated to applicants for all specific emergency exemption granted by EPA. The Section 18 re-certification eligibility list is available on EPA's website (http://www.epa.gov/opprd001/section18/re-certification.htm).

B. Submission Instructions

To submit a section 18 emergency exemption application, send the original and one copy of the application (and any accompanying data or attachments) to the Section 18 Team using one of the methods shown below. Please do not submit applications to any other address. Applications which are submitted to the Division Director, the Director of Pesticide Programs, the Assistant Administrator, the Administrator, or a similar office will result in further delays and will not expedite the processing of your application. Since anthrax-contaminated letters were sent through the U.S. mail in late 2001, the most direct and reliable way of submitting a section 18 request is by overnight carrier (Fed Ex, UPS, etc.).

U.S. Mail

Conventional mail is diverted out of the building for precautionary decontamination prior to delivery to the addressee. Thus, delivery of conventional mail will be delayed. Nonetheless, conventional mail should be sent to:

Addressee
Section 18 Team (7505P)
U.S. EPA, Office of Pesticide Programs
1200 Pennsylvania Avenue N.W.
Washington, D.C. 20460

Overnight Delivery

For overnight delivery, (first ensure delivery will occur between 9:00 AM and 3:00 PM weekdays, excluding Federal holidays), send completed application to:

Dan Rosenblatt, Chief
Risk Integration, Minor Use and Emergency Response Branch (7505P)
U.S. EPA, Office of Pesticide Programs
One Potomac Yards - Seventh Floor
2777 S. Crystal Drive
Arlington, VA 22202

An application will not be processed until the complete application, including all attachments and accompanying data, has been received. The FAX or electronic messaging (E-mail) is suggested when submitting supplemental information to follow-up on a previously submitted application, or notification of a crisis exemption. However, it is generally not recommended to use either of these when sending documents with numerous pages.

FAXES
Send Faxes to:

Anthony Britten, Section 18 Team Leader
Section 18 Team
Risk Integration, Minor Use and Emergency Response Branch
FAX number: (703)605-0781

All applications received by the Section 18 Team will be acknowledged by phone, in writing or email. If you do not receive acknowledgment, you should verify that your application has been received by phoning the section head. The attached personnel resource listing at the end of these instructions contains the current names and phone numbers of the Section 18 Team staff.

II Itemized Instructions

The sections which follow coincide with the sections of the sample application format provided. Each section contains a detailed description of the information that should be provided in the corresponding sections of the application. The 40 CFR references for the different sections of the application requirements are listed where applicable.

In addition to the information required in the application as specified in the following instructions, the emergency exemption application must include a written request for the exemption from the head of the Federal or State Lead Pesticide agency, the Governor of the State involved, or their official designee. In the case where a designee has been delegated the authority to request exemptions, written authorization of such delegation must be on file with the Agency. The cover letter requesting the emergency exemption must accompany the application at the time of submission.

A General Information Required

1. Type of Exemption: Indicate type of exemption - specific, public health, or quarantine.

2. Identity of Contact Persons (166.20(a)(1): Identify contact person for administrative purposes. The contact person will be assumed to be the person who signed the

application unless otherwise specified. Be sure to include phone and fax ~ numbers, and the correct address to which all correspondence should be mailed.

Additionally, identify one or more qualified experts and their areas of expertise who may be contacted regarding the various aspects of the emergency situation. The qualified expert should not have a financial interest in the decision. Be sure to include phone and fax numbers.

3. Description of Pesticide (166.20(a)(2): Identify the active ingredient using the accepted American National Standards Institute (ANSI) name or the most accurate , common chemical name.

   For federally registered pesticides, the application should specify the EPA Registration Number, registrant, and the trade name of the product. If a specific product is not requested, specify the formulation(s) requested and the percent active ingredient. Provide a copy of the federally registered label and any additional labeling proposed for the emergency exemption use which will be distributed. Any supplemental directions for use will be listed in the authorizing telegram which may be distributed to individuals involved with use under the emergency exemption.

   For all other pesticide products, the application should include a confidential statement of formula or a reference to one already submitted to the Agency as part of a previous or pending action for this active ingredient (give EPA File Symbol, EUP number, or SLN number), and complete labeling which will be used in connection with the proposed exemption use. Also include a description of how unused material will be disposed of upon expiration of this exemption.

4. Description of Proposed Use (166.20(a)(3)): The application shall specify all of the following:

   a. The sites to be treated, including specific locations within the state. Specify the names of counties where applications will occur if not statewide. (As much detail as possible, e.g., proximity to water bodies, residences, etc. will particularly aid EPA review.);

   b. The method of application. Be as specific as possible with respect to method, particularly if an innovative method which may reduce exposure will be used;

   c. The rate of application in terms of both active ingredient and formulated product;

   d. The maximum number of applications;

   e. The total acreage (or other appropriate units) to be treated under the exemption. This should be the maximum acreage anticipated, but should not be excessive, since risk assessments will be based on maximum acreage;

   f. The total amount of pesticide to be used in terms of both active ingredient and formulated product;

g. The use season or that period of time for which use of the chemical is requested. If production and distribution of the pesticide product will be a concern, please explain (while this information is not required in the regulations, it is very useful);

h. All applicable restrictions, user precautions and requirements concerning the proposed use and the qualifications of applicators.

5. Alternative Methods of Control (166.20(a)(4): The application shall state whether there are any registered pesticides for the proposed use. In the case of existing registered alternatives, the application shall contain a detailed explanation of why each of these products are not sufficient to control the emergency. If the applicant is claiming a lack of efficacy for the registered alternatives, field data demonstrating the ineffectiveness of the registered alternatives must be included with the application.

   Under extenuating circumstances or in the absence of such field data, written statements from qualified agricultural experts, extension or university personnel, or other persons similarly qualified in the field of pest control verifying the lack of efficacy will be acceptable. If a pesticide is available but not recommended by the appropriate State officials, an explanation of why it is not recommended must be provided. If a pesticide is included in the State recommendations but determined to be ineffective for this particular emergency situation, this discrepancy must also be explained.

   If the necessary application equipment to use a registered pesticide is not available, an explanation of what attempts were made to obtain use of the necessary equipment and the results of those attempts must be provided.

   If the applicant is claiming the registered alternatives are not available in sufficient quantities, the application should contain a detailed explanation of what attempts were made to obtain an adequate supply and results of these attempts.

   The application shall also contain a detailed explanation, supported by field data, of why it is not economically and/ or environmentally feasible to employ alternative control practices to resolve the emergency.

6. Efficacy of Use Proposed Under Section 18 (166.20(a)(5): The application must contain data, a discussion of field trials, or other evidence (e.g. experimental testing, small plot trials, laboratory trials, or corroborating evidence from similar uses) which provided the basis for the conclusion that the proposed pesticide treatment will be effective in alleviating the emergency.

7. Residues in Food (166.20(a)(6): For purposes of section 18, food commodities will include raw agricultural commodities, processed food, and potable water. Residue levels must be estimated for all the food commodities even if residues in a processed food are expected to be lower than those in the treated commodity. The application shall address whether residues are expected in or on food, a list of food item(s) likely to contain

residues, and an estimate of the maximum amount of residues likely to result from the proposed use.

If residue levels are expected to be non-detectable, the application should so state and specify the limit of detection.

The residue data from which the above residue estimate is derived must be provided if not already on file with the EPA. If data are on file with the EPA please provide the appropriate reference number (tolerance petition or MRID number) for locating the file.

If certain potential food/feed items will not be allowed into the marketplace, cite method for controlling distribution in the marketplace (e.g. fresh market only).

8. Discussion of Risk Information (166.20(a)(7)): The application shall address the potential risks to human health, endangered or threatened species, beneficial organisms, and the environment from the proposed use. A description of the application sites including proximity to aquatic systems, endangered species habitats, residences, etc., as well as soil type should be provided (as much detail as possible will expedite the Agency's review), along with references to data or other supporting information. Proposals to mitigate risks (protective clothing, setback restrictions, soil-type restrictions, etc.) should be listed here.

   a. Human health: FQPA requires the EPA to consider aggregate exposure from multiple routes (food, water and the environment) when reviewing Section 18 applications. The following information (most of which can be obtained from registrants) must be submitted with all food/feed use Section 18 request:

      1. Groundwater: The request should include information and available modeling data on the persistence, mobility and chemistry for the product where there is a potential for transfer of residues to drinking water. It should also provide information on any drinking water monitoring program in the state.
      2. Residential Use: Information on residential uses of the chemical.
      3. Mode of Action: Data on other pesticides with same mode of action as the active ingredient being requested in the Section 18.
      4. Timing of Crop Harvest: A time-limited tolerance must be established for all Section 18 food/feed uses. EPA needs to know the earliest anticipated harvest date so that they will be able to establish the time-limited tolerance prior to harvest.
      5. Worker Protection Standard: Any applicable WPS requirements need to be addressed in the request and on proposed labeling.

   b. Environmental Issues: Environmental hazards will be identified in this part of the Section 18 request. Environmental hazard mitigation statements will be required for pesticides that are toxic to fish, or wildlife, or have the potential for contaminating groundwater or surface water. These statements should be

consistent with standard EPA language, unless their state department determines that more specific restrictions are necessary. Environmental hazards that are adequately mitigated by the Section 3 label do not need to be mitigated on the Section 18 request.

9. Coordination with Other Affected State/Federal Agencies (166.20(a)(8)): The application should indicate whether the proposed use of the pesticide is likely to be of concern to other Federal or State agencies, and list those agencies that have been contacted. Any comments received from the affected agencies must be submitted with the application or forwarded as they are received to the EPA.

   Prior to submitting the emergency exemption application to EPA, the applicant should request the Endangered Species Specialist in the Regional Office, U.S. Fish and Wildlife Service to provide the applicant with a "species list" of the endangered or threatened species that are present in the areas to be treated (applicant must provide USFWS with the locations of pesticide applications under the proposed exemption). The species list provided by the Fish and Wildlife Service must be included in the application for the emergency exemption.

10. Notification of Registrant (166.20(a)(9): The application shall contain a statement or evidence that registrants or basic manufacturers of all products proposed for use under the emergency exemption have been notified of the exemption request. A copy of a letter from the registrant is preferred. This letter might also include information on the progress towards registration of the proposed use (See “Repeat Uses” below).

11. Enforcement Program (166.20(a)(10): The applicant shall provide an explanation of the legal authority and program resources of the applicant or related State or Federal agencies for ensuring that use of the pesticide under the proposed exemption will comply with any special requirements imposed by the Agency under the section 18.

    A description of the program and procedures for assuring such compliance will be required with each exemption when the use involves:

    a. A pesticide containing an active ingredient which has not been federally registered for use on a food commodity.

    b. A canceled or suspended pesticide use.

    c. A potential hazard to human health or the environment if the provisions of the exemptions are not strictly enforced.

12. Repeat Uses (166.20(a)(11): If an applicant has previously been exempted under section 18 for the use of the same chemical/site combination, the application shall include an interim or final report (if the final report has not already been filed) containing all the information required under 40 CFR 166.32 to the extent available at the time the application is made.

13. Progress Toward Registration (166.25(b)(2)(ii): One of the factors the Agency must consider in evaluating a repeated specific or public health exemption is the progress which has been made toward registration of the proposed use. The regulations further state that if a complete application for registration of a use, " which has been under a specific or public health exemption for any 3 previous years," has not been submitted, it shall be presumed that reasonable progress toward registration has not been made. This standard applies to uses which have been requested for any 3 previous years, regardless of whether the requests were granted or denied.

With respect to IR-4 minor food uses, the Agency will exercise its discretion in determining whether or not reasonable progress toward registration has been made on IR-4 minor food uses. Generally, IR-4 minor food uses will be judged against a 5-year standard, as opposed to a three year standard for all other uses.

Once a complete application for registration has been submitted, progress toward registration will be evaluated on a case-by-case basis. In general, the Agency is not inclined to grant repeat exemptions unless reasonable progress toward registration has been made.

Prior to making an application for a repeat specific or public health exemption, the state or federal agency should contact the registrant regarding the progress being made toward registration of the proposed use. The section 18 application should contain a discussion of progress toward registration, including a summary of deficiencies and data gaps and the registrant's timetable for rectifying registration deficiencies.

B. Requirements for Specific Exemptions

The majority of specific exemptions requested are based on a potential significant economic loss as a result of a pest outbreak or unusual environmental conditions. An application for this type of specific exemption should include the information specified below.

1. Scientific and Common Name of Pest (166.20(b)(1)): The application shall specify the scientific and common name of the pest or pest complex for which use of the chemical is sought.

2. Discussion of the Emergency Condition (166.20(b)(2)): The application shall include a discussion of the events which brought about the emergency (weather conditions, severe pest pressure; resistance development, pesticide cancellations, etc.). Claims of severe pest or disease pressure must be documented with data or written testimony of qualified experts. When an exemption application is submitted prior to the -' existence of an emergency condition, a detailed explanation of why such emergency condition is expected must be submitted. This type of exemption application would be authorized based on a "threshold level." A threshold level would be the level at which the Agency had determined that an emergency condition would exist. The Applicant should propose a threshold level for the Agency's consideration. Examples of threshold levels include a specified number of plant pests per plant, some level of rainfall occurring within a specific time frame, the presence of weeds at a given crop stage, or some percentage of crop defoliation due to a pest. Once a pest population or a situation progressed to this threshold level, use under the exemption would be allowed.

   If resistance development, phytotoxicity, or similar claims are the basis for the emergency exemption, the applicant must include evidence (in the form of field or laboratory data) to support his claim. Written testimony from qualified experts may be acceptable when data are not available.

   In addition to efficacy data for the proposed pesticide, registered alternative pesticide, and alternative practices, discussed previously in section II.A.5 and 6, yield data from studies comparing the proposed pesticide to the next best alternative(s) should be provided by the applicant, if available, to substantiate yield loss claims.

3. Discussion of the Anticipated Risks to Threatened or Endangered Species, Beneficial Organisms, or the Environmental That Would Be Remedied By the Proposed Use of the Pesticide: If the emergency exemption is needed to address risks to a E/T species, beneficial organism or the environment, then provide information which demonstrates those risk and how using the pesticide will mitigate the risks.

4. Discussion of Significant Economic Loss: If the emergency exemption is needed to address a significant economic loss (SEL), then discuss the anticipated SEL associated with the emergency condition and provide data and other information supporting the discussion. EPA considers that a SEL would result from the non-routine condition if the threshold for any of the following tiers is met (per 40 CFR 166.20):

   - Tier 1 – Yield Loss of at Least 20%: Yield loss due to the non-routine condition must be estimated assuming the use of the best available alternative controls.
     Supporting Data: Comparative efficacy or economic injury studies documenting percentage yield loss comparing yields without an emergency with those involving the best available control means.

   - Tier 2- Total Economic Loss of at Least 20% of Gross Revenue: In addition to losses in gross revenue due to yield losses, total economic loss includes other impacts resulting from the non-routine condition, such as quality losses that cause reductions in price and losses owing to increased production costs. Total economic losses will be compared to baseline gross revenue, that is, gross revenues expected in the

absence of the non-routine condition.
Supporting Data: Data for Tier 1, plus: Data involving baseline yield and price information from the USDA National Agricultural Statistic Service or other appropriate sources. Quality loss data documenting shift in grade or uses from marketing studies or surveys from economic injury studies; added production costs from marketing studies and surveys, labor demand studies or crop budget. Similar to Tier 1, the critical comparison involves revenue without an emergency situation versus productions for losses expected when using the best alternative control.

- Tier 3 – Total Economic Loss of at Least 50% of net operating revenues: Total economic losses, as defined in Tier 2, will be compared to baseline net operating revenues. Net operating revenues are defined as gross revenues less variable operating costs.
  Supporting Data: Data for Tier 2, plus: Baseline variable production costs from enterprise budgets: purchased inputs such as pesticides and hired labor; fuel costs should be included. Other items that are relevant to short-term operating costs such as costs for seed, fertilizer, irrigation, labor, and typical pest management costs. However, longer-term obligations should not be included.

It may be difficult to submit comprehensive data for certain fast-moving and emerging pest problems, or for very minor use or new crops. If such data are not available, EPA may consider using qualitative information in making its decision. However, if an exemption is granted on the basis of qualitative data, EPA will require that substantiating data be generated during the first year of use, and submitted to support any repeat requests.

For any pest activity where EPA determines that the above criteria would not adequately describe the expected loss: substantial loss or impairment of capital assets, or a loss that would affect the long-term financial viability expected form the productive activity.

For example, an emergency exemption may be justified for a pest problem that adversely affects a perennial crop, but does not meet the SEL criteria for yield and/or revenue losses for a single year of production. An emergency exemption may also be justified for pest problems unrelated to agricultural production, such as for protection of structures or park land.

Any non-economic or qualitative information which describes the benefits from using the pesticide will be taken into consideration by EPA.

C. Quarantine Exemption Requirements

A quarantine exemption may be authorized in an emergency condition to control the introduction or spread of any pest new to or not theretofore known to be widely prevalent or distributed within and throughout the United States and its territories. In addition to the information required in Section “A” of this document, the application for the quarantine exemption should include the information specified below.

1. Scientific and Common Name of Pest (166.20(c)(1): The application shall specify the

scientific and common name of the pest or pest complex for which use of the chemical is sought.

2. Origin of Introduced Pest (166.20(c)(2): The application shall provide the origin of the pest and the means of its introduction and spread into the area if known.

3. Impact of the Pest (166.20(c)(3): The application shall indicate the anticipated impact of not controlling pest and any other information pertinent to the economic importance of this pest.

D. Public Health Exemption Requirements

A public health exemption may be authorized in an emergency condition to control a pest that will cause a significant risk to human health. In instances involving a significant risk to human health due either to the pest itself or a disease for which the pest is a vector, there does not necessarily have to be an outbreak of a pest population but rather an increase in the disease incidence within a pest population. The application for the public health exemption should include the information specified below:

1. Scientific and Common Name of Pest (166.20(d)(1): The application shall specify the scientific and common name of the pest or pest complex to be controlled and, if the pest is a vector, a description of the disease it is expected to transmit.

2. Health/Pest Problem (166.20(d)(2): The application shall provide a discussion of the magnitude of the health problems which are expected to occur without the use of the pesticide and resultant spread of the pest.

3. Medical Treatment (166.20(d)(3): The application shall provide a discussion of the availability of medical treatments available to remedy any resultant health problem associated with the spread of the pest.

E Crisis Exemption Requirements

A crisis exemption may be issued by the head of a Federal or State agency, the Governor of a State, or their official designee in situations involving an unpredictable emergency situation when an emergency situation exists and the time element with respect to the pesticide application is critical and there is not sufficient time to request a specific, quarantine, or public health exemption, or if such a request has been submitted, for the EPA to complete its review of the application. Also, prior to issuance of a crisis exemption, the Federal or State lead agency must receive verbal confirmation from EPA that, for food uses, a tolerance or exemption from the requirement of a tolerance can be established in a timely manner, responsive to the projected timeframe of use of the chemical and harvest of the commodity, and that, for any use, the Agency has no other objection.

The issuing agency must comply with the provisions specified below once a decision to avail itself of a crisis exemption has been reached.

1. Limitations (166.41): The crisis provisions may not be utilized if any of the following

apply:

a. EPA has instructed the head of the Federal or State agency, Governor, or official designee not to issue such a crisis exemption;

b. The pesticide use has been suspended under section 6(c) of FIFRA;

c. The pesticide use has been canceled under section 6(b) of FIFRA;

d. The pesticide contains a new chemical (active ingredient not contained in a currently registered pesticide); or

e. The application proposes the first food use of a pesticide (use of a pesticide on a food or in a manner which otherwise would be expected to result in residues in a food, if no permanent tolerance, exemption from tolerance, or food additive regulation for residues of the pesticide on any food has been established for the pesticide under §408 or §409 FFDCA).

2. Notification (166.43(a)): The State or Federal agency issuing the crisis exemption must notify the Administrator in advance of utilization of the crisis provisions.

3. Contents of the Notice (166.43(b)): The above notice shall include all of the following:

a. The name of active ingredient authorized for the crisis use, including the common name and the Chemical Abstracts Service (CAS) number;

b. The crop or site on which the pesticide is to be used;

c. The use pattern (method, number, and rate of applications);

d. The dates that applications started or will begin and end;

e. An estimate of the level of residues of the pesticide expected to result from use under the crisis exemption (for food crops); and

f. A discussion of the emergency situation and any other pertinent information available at the time, including an explanation why time was insufficient to request a specific or quarantine exemption and intentions with respect to requesting a specific exemption for this use.

The State or Federal agency issuing the crisis exemption shall notify the registrant(s) or, if appropriate, the basic manufacturer(s) of the pesticide(s) being used under the crisis exemption at the same time notice is given to the EPA or as soon thereafter as possible.

F. Submission of Final Reports

40 CFR 166.32 states that a report summarizing the results of the pesticide use under an

emergency exemption must be submitted to the Agency no later than six months from the expiration of the exemption unless otherwise specified by the Agency. Please note the final report for crisis exemptions is due no later than three months following the date of the last application unless followed with a specific, quarantine, or public health exemption for the same use. In this case the final report for the crisis exemption may be incorporated into the final report for the specific, quarantine, or public health exemption, but the report should clearly indicate that it covers both exemptions.

Please be sure to reference the EPA assigned emergency exemption number (09-TX-O1, etc.) when submitting final reports to the Agency. Final reports should be submitted under separate cover and not included in subsequent emergency exemption requests for the same use. A copy of the final report sent to EPA headquarters should also be sent to your EPA Regional Office.

The final report for an emergency exemption shall include the following information:

1. The total acreage, amount of commodity, or other unit treated under the exemption, and the total quantity of pesticide used;

2. A discussion of the effectiveness of the pesticide used in dealing with the emergency condition;

3. A description of any unexpected adverse effects which may have resulted from the use of the pesticide under the emergency exemption;

4. The results of any compliance monitoring required and/or carried out under the exemption;

5. A discussion of any enforcement actions taken in connection with the exemption;

6. The method(s) of disposition of a food crop, if required to be destroyed, under an exemption;

7. Any other information requested by the Administrator in connection with the granting of an exemption; and

8. In the cases where a crisis exemption was declared, an explanation as to why there was a need to utilize the crisis provisions.

Section 18 Team Contacts Risk Integration, Minor Use, and Emergency Response Branch		
Dan Rosenblatt, Chief	(703)308-9366	rosenblatt.dan@epa.gov
Anthony Britten, Team Leader	(703)308-8179	britten.anthony@epa.gov
Andrea Conrath	(703)308-9356	conrath.andrea@epa.gov
Andrew Ertman	(703)308-9367	ertman.andrew@epa.gov
Stacey Groce	(703) 305-2505	milan.stacey@epa.gov
Princess Campbell (Dr.)	(703)308-8033	campbell.princess.@epa.gov
Libby Pemberton	(703)308-9364	pemberton.libby@epa.gov
Marcel Howard	(703)305-6784	howard.marcel@epa.gov
Fax Number:	(703)605-0781	

Appendix I
Risk Analysis

APPENDIX I

Summary of Risk Analysis Team

Issue: Asian carp risk assessment and risk management in the Chicago Sanitary and Ship Canal (CSSC), Des Plaines River, and I&M/Deep Run Creek to prevent establishment and impacts of bighead and silver carps (i.e., Asian carps) in the Great Lakes

Report submitted on behalf of Team Members
Steve Shults, Greg Sass, John Epifanio, and Mike Hoff

Compiled by
Mike Hoff

Background

Risk analysis is a process consisting of three components: risk assessment, risk management and risk communication (http://www.fsra.eu/glossary.html). Risk assessment is a scientifically based process consisting of hazard identification, hazard characterization, exposure assessment, and risk characterization. Risk Management is a process, which is distinct from risk assessment, of weighing alternatives to minimizing risk. Risk communication is the interactive exchange of information and opinions throughout the risk analysis process concerning hazards and risks, risk-related factors and risk perceptions, among risk assessors, risk managers, consumers, industry, the academic community and other interested parties, including the explanation of risk assessment findings and the basis of risk management decisions. This document communicates the findings of the Risk Analysis Team (Team; Assessors were Steve Shults, Greg Sass, John Epifanio, and Mike Hoff). Steve Shults was selected because he is the Aquatic Nuisance Species Program Coordinator for Illinois Department of Natural Resources, while Greg Sass was selected because of his expertise in the biology and ecology of Asian carps in Illinois, John Epifanio was selected because of his expertise in genetic science, and Mike Hoff was selected because of his expertise in risk analyses.

The findings in this report include a summary of risk assessments conducted individually by each Team member, and recommendations for risk management to minimize risk of Asian carps invading, becoming established, and significantly impacting the Great Lakes. The qualitative risk assessment method used in this process was modified Generic Non-indigenous Aquatic Organisms Risk Analysis Review Process that was developed by the U.S. Aquatic Nuisance Species (ANS) Task Force in 1996 (Risk Assessment and Management Committee 1996). For more detailed responses submitted by Assessors, read the information contained in each Assessor's Risk Analysis form.

Risk Assessment of Asian Carps

Risk of invasion of the Great Lakes by Asian carps includes risk of establishment and consequence of establishment. Those two factors are merged into a risk characterization called Organism Risk Potential, which is risk of introduction, establishment, spread, and impact on the Great Lakes ecosystem.

Risk of establishment, based on Assessor ratings, and uncertainty levels in those ratings, include Asian carps: 1) association with the geographic pathway (i.e., CSSC, Des Plaines River, I&M/Deep Run), 2) surviving in the Great Lakes, 3) establishing populations in the Great Lakes, and 4) spreading in the Great Lakes.

Consequence of establishment, based on Assessor ratings, and uncertainty levels in those ratings, include Asian carps: 1) ecological impact, 2) economic impact, and 3) political impact.

Prior to Assessors rating risk of establishment and consequence of impact, Assessors stated their answers to two questions:

1. I believe that the technical approach (sampling, laboratory, and QA/QC methods) used by Notre Dame is enough evidence on which to base an expensive, and possibly controversial rapid response action?
2. I believe that there is no evidence that silver carp (and/or bighead carp) established self-sustaining populations either above the electrical barriers or any location within the Great Lakes.

Three Assessors (answered "Yes" to question 1, and one Assessor answered by stating he was "Moderately Certain" about the situation described in that question. Two Assessors answered "Yes" to question 2, whereas one Assessor answered by stating "To the best of my knowledge, I believe this is a true statement," another Assessor answered by stating he was reasonably uncertain about the situation described in that question.

Organism Risk Potential, by Assessor, for Asian carps invading the Great Lakes by geographic pathway, is listed below. Scoring is from the key developed by the Risk Assessment and Management Committee (2006).

Assessor 1

- Probability of Establishment Risk Category = High for CSSC and Des Plaines, Medium for I&M/Deep Run
- Consequence of Establishment Risk Category (from all geographic areas considered together; from tables in Assessors form) = Medium
- Organism Risk Potential = High for CSSC and Des Plaines, and Medium for I&M
- Minimum Certainty = Reasonably Certain for Probability of Establishment in the Great Lakes via CSSC, Moderately Certain for Des Plaines, and Reasonably Uncertain for I&M; Reasonably Uncertain for Consequence of Establishment

Assessor 2

- Probability of Establishment Risk Category = Medium for CSSC, Des Plaines, and I&M/Deep Run
- Consequence of Establishment Risk Category (from all geographic areas considered together; from table above) = High
- Organism Risk Potential = High for CSSC, Des Plaines, and I&M
- Minimum Certainty = Reasonably Certain for Probability of Establishment in the Great Lakes via CSSC, Des Plaines, and I&M; Reasonably Uncertain for Consequence of Establishment

Assessor 3

- Probability of Establishment Risk Category = High for CSSC and Des Plaines, Medium for I&M/Deep Run
- Consequence of Establishment Risk Category (from all geographic areas considered together; from table above) = High
- Organism Risk Potential = High for CSSC, Des Plaines; Medium for I&M
- Minimum Certainty = Moderately Certain for Probability of Establishment in the Great Lakes via CSSC and Des Plaines, and Very Uncertain for I&M; Moderately Certain for Consequence of Establishment

Assessor 4

- Probability of Establishment Risk Category = High for CSSC and Des Plaines, Medium for I&M/Deep Run
- Consequence of Establishment Risk Category (from all geographic areas considered together; from table above) = High
- Organism Risk Potential = High for CSSC, Des Plaines, and I&M considered together
- Minimum Certainty = Very Certain for Probability of Establishment in the Great Lakes via CSSC, Moderately Certain for Des Plaines, and Reasonably Uncertain for I&M; Reasonably Certain for Consequence of Establishment.

Risk Management

Risk management recommendations, by Assessor, are listed below.

Assessor 1

1. Based on the risk assessment (above), what management actions (and short justification) are recommended within the next:
    a. 30 days?
    b. 60 days?
        i. Permanently block fish movement through CSSC via technologies to address all life stages of Asian carps.
        ii. Develop redundancy in system to preclude fish by-pass in the event of catastrophic failure of individual components.
    c. 90 days?
        i. Permanently close connections between DPR and CSSC.
    d. 6 months?
        ii. Permanently close connections between I&M Canal and CSSC.
    e. 1-year?

2. What variables need to be accounted for in each of the management actions listed above?
    a. 30 days?
        i. Population Verification (presence / absence) in DesPlaines and I&M Canal by all means necessary.
    b. 60 days?
    c. 90 days?
    d. 6 months?
    e. 1-year?

Assessor 2

1. Based on the risk assessment (above), what management actions (and short justification) are recommended within the next:
    a. 30 days?
        i. Disconnection of the Des Plaines and I & M to upstream of the barrier in the CSSC. Barrier IIA kept at 2 volts/inch as long as possible and a greater sense of urgency to get the small fishes testing done within the barrier. I am funded by EPA to test the response of small fishes in the electric field. Due to safety concerns, I am currently not allowed to complete this study due to Coast Guard restrictions. Research conducted in Vicksburg on small fishes in flumes may not replicate what happens in the CSSC.

b. 60 days?

   i. A physical specimen of an Asian carp should be collected from an area where they have not been collected, but determined to be present by eDNA. Construction of Barrier IIB should be initiated immediately. Rotenone should be applied to the Lockport Reach if Barrier IIA must be shut down for repair or if a physical specimen is captured below the barrier in the Lockport Reach.

c. 90 days?

d. 6 months?

e. 1-year?

   i. SPA-driven BAFF's completed at Ruby Street and on Des Plaines. It is highly likely that these systems will not thwart all Asian carp attempts to pass. Therefore, I would suggest using these systems to deter and corral Asian carps where they can be physically removed to reduce propagule pressure. Funding is needed to support a study to determine where Asian carps are most likely to survive and reproduce in the Great Lakes watershed. Additional funding is also needed to make predictions about the food webs where these species might survive and reproduce to determine effects on other trophic levels. Lastly, strong consideration of physically separating the UMRB and the Great Lakes Basin.

2. What variables need to be accounted for in each of the management actions listed above?

   a. 30 days?

      i. Where will water be diverted during large flood events? Barrier IIA shutdown for maintenance.

   b. 60 days?

      i. Will it be even more difficult to capture an Asian carp in the vicinity of the barrier during fall/winter conditions when their metabolism slows down?

   c. 90 days?

   d. 6 months?

   e. 1-year?

      i. Constructing SPA-driven BAFF's of this magnitude may take a long time. Further, total effectiveness of blocking all passage attempts by Asian carps is not likely. Who will fund much needed studies to predict impacts on Great Lakes ecosystems? EPA might, but the RFP is still not available. Public, political, and economic outcry if the CSSC was disconnected from Lake Michigan (e.g. recreational boaters, commercial barge traffic).

Assessor 3

1. Based on the risk assessment (above), what management actions (and short justification) are recommended within the next:

   a. 30 days?

      i. Confirm the eDNA method (independent review & independent lab – e.g., NMFS NWFSC should have capability to this kind of sample analysis in the lab). While

the rapid response actions will be needed eventually, it would be good to confirm that they are needed “right now”.

b. 60 days?

   i. Confirm that DNA has a short retention time in conditions similar to CSSC. Confirm that alternative means for DNA to move upriver are excluded from consideration. While the rapid response actions will be needed eventually, it would be good to confirm that they are needed “right now”.

c. 90 days?

   i. Identify if any candidate spawning areas exist above the barrier.

d. 6 months?

   i. Need to shore up any separations between CSSC and the DPR and I&M before the next rainy season.

e. 1-year?

   i. Assess alternative sampling methods (nets, weirs, chemicals) and alternative barrier technologies (bubbles, sounds, pheromones)

2. What variables need to be accounted for in each of the management actions listed above?

   a. 30 days?

   b. 60 days?

   c. 90 days?

   d. 6 months?

      i. ID where “breaches” occur.

   e. 1-year?

      i. Radio-track adults captured at Lockport to see where they go and how fast. Probably need long-term tags.

Assessor 4

1. Based on the risk assessment (above), what management actions (and short justification) are recommended within the next:

   a. 30 days

      i. Highest Priorities (all are high priorities; not listed in descending order)

         - CSSC

            - Delay maintenance of Barrier IIA until November

            - Close Lockport Lock and Dam and conduct rotenone treatment from overhead pipeline above barrier system to Lockport Lock and Dam, at a minimum

            - Conduct barrier maintenance after rotenone treatment

- After rotenone treatment, continue e-DNA monitoring above and below (Lockport Pool) the barriers
- Explore and use appropriate, additional actions to prevent Asian carp from immediately locking back into the Lockport Pool including closing the Lock there until Barrier II is complete, and possibly also install a SPA/BAFF immediately below Barrier II

- Des Plaines River
  - Immediate actions are needed to prevent the movement of Asian carp from the Des Plaines to the CSSC during a high water event.
    - Complete the USACE study, and implement recommended actions that may include temporary barriers, at Forest Preserve District bike trail and other priority locations, to reduce the risk of Asian carps reaching the CSSC up to 100-year flood stage.
      - Semi-permeable barriers (e.g., fencing) could be installed relatively quickly. This is will reduce risk until land elevations can be temporarily raised (e.g., Jersey barriers, sand bags). Temporary barriers that increase land elevations may be more reliable and desirable, but are probably will take longer to get installed.
  - Consider all actions to minimize the number of Asian carps in, and entering, until the Des Plaines has been hydrologically separated from CSSC in 100-year flood conditions i. Actions could include: 1. Limited spot treatments using rotenone to verify presence and relative abundance of Asian carps. a. If found in abundances assessed too high, based on expert opinion, then treat with rotenone the entire Des Plaines below the appropriate physical barrier

- I&M Canal/Deep Run Creek
  - Conduct a hydrologic study to determine the location and extent of direct (i.e., culverts) and temporary (i.e., overland flooding during high water events) connections with the CSSC.
    - Close road culverts connecting I&M Canal/Deep Run and CSSC
    - Implement actions recommended to establish permanent hydrologic separation between systems at or above 100-year flood level.
  - Until the location of these connections can be determined, actions are warranted to prevent the movement of Asian carp into I&M/Deep Run. i. Some form of physical barrier would be preferred action, but a SPA/BAFF should at least reduce the risk of large numbers of Asian carps from entering
  - Consider limited spot treatments using rotenone to verify presence and relative abundance of Asian carps.
    - If found in abundances assessed too high, based on expert opinion, then treat with rotenone the entire I&M/Deep Run below the appropriate physical barrier.

        - Prior to these treatments, collect and analyze e-DNA samples from I&M/Deep Run 1. This will help test efficacy of e-DNA sampling in this water
    - If the connections with the CSSC are not either immediately addressed or a installed immediately between I&M/Deep Run and CSSC, then a rotenone action in Brandon Road Pool may be warranted to minimize the risk of Asian carps moving in large numbers up the I&M/Deep Run.
  - Rapid Assessment (Monitoring)
    - Lead agencies should insist upon expert review of e-DNA field technique, including QA/QC, and all data analyzed.
    - Immediate e-DNA sampling up to identified backwaters in Des Plaines River between Lemont and Romeoville Road.
    - When rotenone treatments are conducted, incorporate e-DNA testing (below treatment area, immediately before treatment) into those treatments

b. 60 days?
c. 90 days?
d. 6 months?
   i. Highest Priorities (all are high priorities; not listed in descending order)
      - CSSC
        - Complete Barrier IIB to be fully operational prior to the next maintenance period for Barrier IIA (July 2010).
        - Until Barrier IIB is complete, consider additional (i.e., after the one recommended in section 1.a.i.1.b.) rotenone treatments, based on Asian carp abundance between the barriers and Lockport Lock and Dam, and expert opinion of risk of that abundance to passing electrical barriers into the Great Lakes.
      - Des Plaines River
        - Establish a permanent hydrologic separation, at or above 100-year flood level, between the Des Plaines River and CSSC
      - I&M/Deep Run Creek
        - When hydrologic separation from CSSC (at 100-year flood stage) is complete, then consider installing a SPA-BAFF below confluence of Des Plaines River and CSSC (between RM 289 and 290) to direct fish into I&M.
          - Periodic removal of Asian carps from I&M by traditional techniques (electrofishing, netting, commercial fishing, etc.).

e. 1-year?
   i. Highest Priorities (all are high priorities; not listed in descending order)
      - CSSC
        - Complete Barrier IIB

- Complete testing of barrier parameter settings that repel bighead and silver carps at maximum effectiveness
    - Operate barriers II A and IIB at those settings

2. What variables need to be accounted for in each of the management actions listed above?
    a. 30 days?
        i. One of the most important issues is peer review of e-DNA study methods, QA/QC, sample sizes, and positive sample frequency
            - Most management actions listed above are based on the assumption that the e-DNA study is actually detecting presence of Asian carps.
    b. 60 days?
    c. 90 days?
    d. 6 months?
    e. 1-year?

<u>Additional Comments and Recommendations</u>

Assessor 1

- Removal of fish in CSSC is only recommended due to required maintenance of the barrier system AND multiple detects of DNA. The barrier system MUST be enhanced with multiple technologies and redundancy to prevent AC passage in future.
- This RA does not address discrepancies of fish movement (DNA) by boaters, ballast, barges, etc. False positives are addressed, but false negatives are not adequately addressed in the sampling regimen. Prior to expensive and controversial RR plans being undertaken, physical capture should be required in an area to confirm presence of Asian carp OR multiple simultaneous positive detections to eliminate false negatives (i.e., higher probability in CSSC with multiple detects than in DPR with single detect).
- Until barrier system and redundancy is in place, strongly consider closure of canal (at Lockport Lock) to prevent reinfestation of Lockport pool.

Assessor 2

No additional comments

Assessor 3

- Given the probability that there are SV and/or BH approaching the barriers. The highest priority actions will be to shore up the beachhead between where they are and the barriers (bc one will be shut down soon for maint.). This will require a fairly strong PR campaign to ensure citizens that the CSSC is not being “poisoned”. Fact sheets, press releases, experts to interview, and so on. Can bubble and sound barriers be employed quickly?
- Next in priority is the connection between DPR and CSSC.
- Last are the connections between CSSC & I&M.

Assessor 4

- Immediate actions are needed. Although we are focused on very short-term risks and management of them, we must also keep our eyes on the real, long-term prize. Of course,

that prize is the permanent solution to the exchange of aquatic invasive species, between the Great Lakes and Mississippi River Basins, via the Chicago Sanitary and Ship Canal.

- More use of structured decision making is recommended. Risk analysis is one form of structured decision making, and needs to be included in aspects of managing risks of Asian carp introduction, establishment, and impacts in the Great Lakes. Other aspects of structured decision making may complement the use of risk analysis embodied in this form's completion.

Additional Information

Several approaches have been used to assess risk of bighead and silver carp becoming established in the Great Lakes. Kolar and Lodge (2002) used life history characteristics of the species to predict whether become established in the Great Lakes, whereas Herborg et al. (2007; maps attached) used comparisons of climatic, topographic, and hydrologic variables between native ranges and the Great Lakes. Kolar and Lodge predicted that bighead carp could, but silver carp could not establish in the Great Lakes. Herborg et al. predicted that both bighead and silver carp could become established in the Great Lakes.

References

(Note: See specific reference listed in Assessors' Risk Analysis forms)

Risk Assessment and Management Committee. 1996. Generic non-indigenous aquatic organisms risk analysis review process (Report to the Aquatic Nuisance Species Task Force, 21 October 1996) (available at http://www.anstaskforce.gov).

MacIsaac, H.J., Herborg, L., Mandrak, N. E., Cudmore, B. C. 2007. Comparative Distribution and Invasion Risk of Snakehead (Channidae) and Asian Carp (Cyprinidae) Species in North America. *Canadian Journal of Fisheries and Aquatic Sciences.* Vol. 64: 1723-1735.

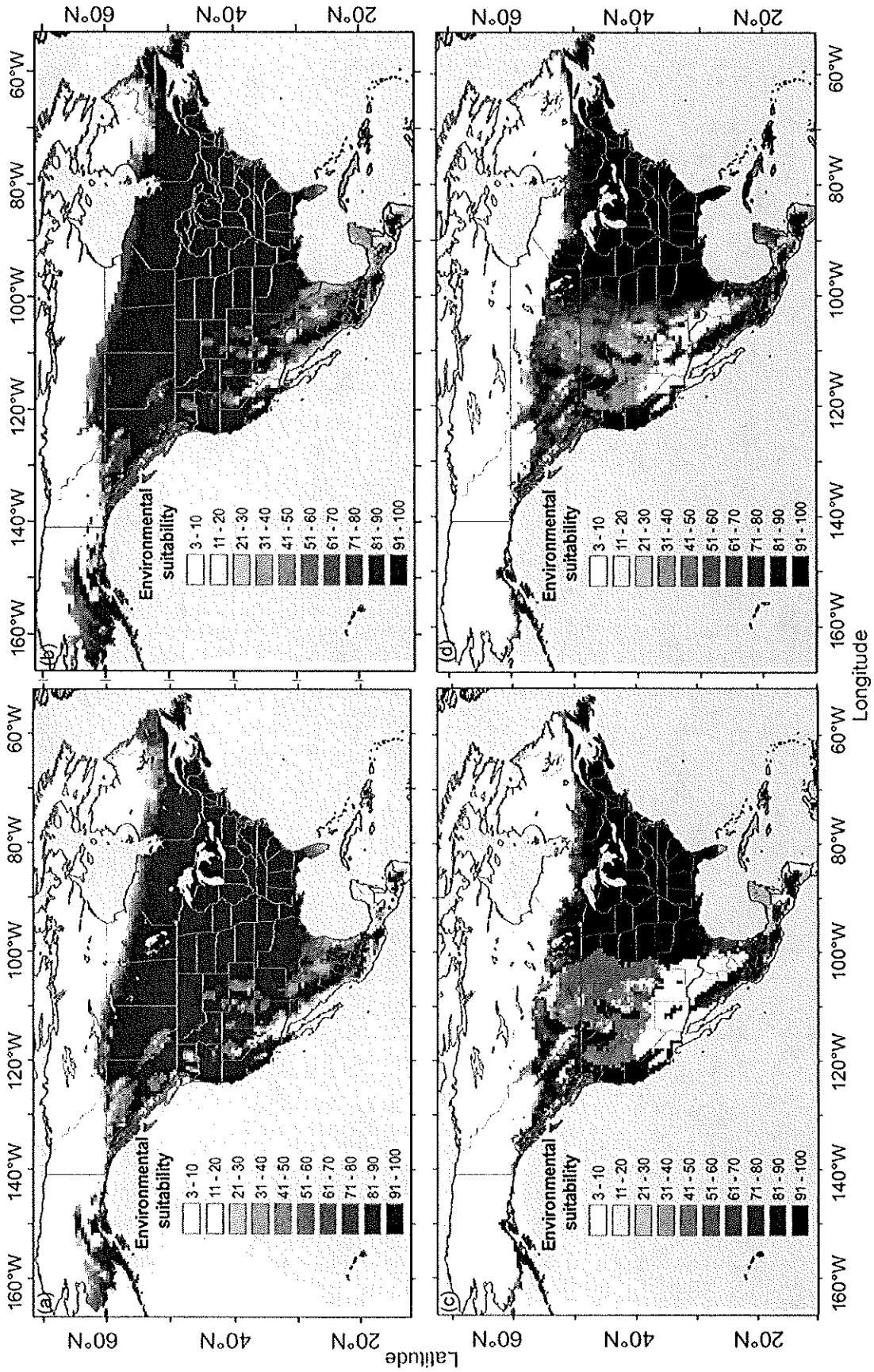


Fig. 2. Predicted suitable environment for four species of Asian carp (Cyprinidae) in North America. Environmental suitability is represented as the number (out of a maximum of 100) of models that predicted a particular location as suitable. (*a*) Grass carp, (*b*) silver carp, (*c*) bighead carp, (*d*) black carp.

© 2007 NRC Canada

Appendix J
Antimycin A and Rotenone Data and Sensitivity Study

Appendix J

Toxicity of Rotenone to Various Organisms

Hines Emerald Dragonfly:

Although relative toxicities of rotenone to various insects exist within the scientific literature, little is known about the specific toxicity of this chemical to the Hines emerald dragonfly (*Somatochlora hineana*). Various species in the family Macromia are reported to have an average 96-hr LC_{50} of 1000 µg/L. This is well above the proposed concentration for treatment of the CSSC.

For more information, visit:

http://www.pesticideinfo.org/List_AquireAll.jsp?Rec_Id=PC35133

Spotted Turtles:

Specific references to toxicity of rotenone to spotted turtles (*Clemmys guttata*) could not be located. However, the range of lethal doses of rotenone-containing piscicides for amphibian larvae and turtles is highly variable (approximately 0.1 - 0.58 mg/L) dependant on species respiration and their ability to exit a treated waterbody. This marginally overlaps with the proposed rotenone treatment dose of 0.170 mg/L (170 µg/L) active ingredient. This treatment dose equates to 3.4ppm formulation of Prenfish (rotenone 5% EC).

The proposed treatment should have little affect on spotted turtles because they are not likely to inhabit the Chicago Sanitary and Ship Canal as preferred habitat.

For further references, see:

Fontenon, L.W., G.P. Noblet, and S.G. Platt. 1994. *Rotenone Hazards to Amphibians and Reptiles.* Herpetological Review 25(4) 150-156.

McCoid, M.J. and P.W. Bettoli. 1996. *Additional Evidence for Rotenone Hazards to Turtles and Amphibians.* Herpetological Review 27(50).

Target Organisms:

The affects of rotenone on various fishes can be located in any rotenone treatment manual and most toxicity databases. However, little or no data previously existed on the specific toxicity of various fisheries chemicals to bighead and silver carp. The International Joint Commission contracted with the USGS Biological Services Division in Columbia, MO. to conduct toxicology testing of rotenone and antimycin A for this project. The report of this testing is included in the following pages:

An Examination of the Sensitivity of Bighead Carp and Silver Carp to Antimycin *A* and Rotenone

Duane Chapman, James Fairchild, Brian Carollo, Joseph Deters, Kevin Feltz, and Christopher Witte

December, 2003

U.S. Geological Survey
Columbia Environmental Research Center
4200 New Haven Road
Columbia, Missouri 65201

http://www.cerc.usgs.gov/

U.S. Department of the Interior
U.S. Geological Survery

Abstract

An electrical barrier has been constructed in the Chicago Ship and Sanitary Canal (CSSC) to prevent movement of invasive species between the Great Lakes and the Mississippi River system. Bighead and silver carp which are present downstream of the barrier may be able to eventually penetrate this barrier. If the fish near the barrier, it may be necessary to remove the fish from immediate vicinity. The only reasonable method to affect the complete removal of the fish is the use of a piscicide. We tested the sensitivity of bighead and silver carp to two piscicides, rotenone and antimycin *a*.

The fish were sensitive to rotenone, falling near the middle of the range of sensitivities reported for various species. A concentration of 250 μg/L, the highest concentration permitted for control of fishes, killed all bighead and silver carp within 4 hours. Both large and small fish were sensitive to rotenone. Rotenone should be a suitable toxicant for the removal of bighead and silver carp from the CSSC.

Bighead and silver carp were fairly insensitive to antimycin *a*. Compared to values in the literature, they were more sensitive than black bullheads, but less sensitive than most other species. A concentration of 20 μg/L, the highest concentration permitted for control of fish at the pH and temperatures likely in the CSSC, required 32 hours to kill all bighead and silver carp. Because the canal is important for commercial transportation, the duration of exposure required to affect the removal of bighead and silver carp with antimycin would be unacceptably long.

Introduction

Bighead carp and silver carp are Asian cyprinids imported to the United States in the 1970's for use in aquaculture and improvement of water quality in municipal effluents. These species have escaped from confinement and now have self-sustaining populations in the Mississippi River basin. The fish have been expanding their range northward up the Missouri, Mississippi, Illinois, and Ohio River systems. Because bighead and silver carp are known to reach high biomasses and because they feed low on the food chain, negative effects on desirable native species are anticipated.

Lake Michigan is connected to the Illinois River system by means of the Chicago Ship and Sanitary Canal (CSSC). This canal is a potential avenue for Asian carp to invade the Great Lakes system. Invasion of the Great Lakes by Asian carp would have unknown and potentially highly deleterious effects on this important fishery, worth billions of dollars annually.

An electric barrier has been constructed in the CSSC to impede invasive species from moving through the canal in either direction. It is still unknown if this barrier will be adequate to keep Asian carp from entering the Great Lakes. Added levels of security in the form of another electrical barrier and other potential barrier types are planned. Until these additional barriers are in place, other control methods may be necessary. If Asian carp invade the section of the CSSC between the barrier and the lock and dam below it, it may be necessary to remove the fish from this section before they have an opportunity to cross the barrier. The use of a piscicide to cause the complete mortality of Asian carp within that section is the only realistic method available for removal of all bighead and silver carp.

Before piscicides can be used, it is necessary to know the sensitivity of the target fish. In addition, the label requirements for antimycin *a*, one of the two piscicides available for this use, require that a toxicity test be performed with the target fish in site water prior to deployment. The following study was performed to fill those requirements.

Methods

We tested the sensitivity of Asian carp to rotenone and antimycin in three testing periods. The first period tested the sensitivity of bighead carp and silver carp to a range of concentrations of rotenone. The second period tested the sensitivity of bighead and silver carp to a range of concentrations of antimycin *a*. During the second period, we duplicated one treatment in full sunlight in an attempt to test the effect of photodegradation. In the third period, we performed a confirmatory test to determine if the piscicide concentrations that caused mortality in the first and second periods would be suitable for Asian carp of different sizes and to determine if those concentrations would be suitable in water collected from the Chicago Ship and Sanitary Canal. Also during the third period we performed another test with antimycin *a*, similar to that performed in the second period, but with only three concentrations, to determine if a different method of mixing resulted in different toxicity. Table 1 lists the treatments that were performed in the three periods. All treatments in all tests were "static"; all toxicants were added at the beginning of the test and there was no renewal of water during the test. Both rotenone and antimycin are known to oxidize, therefore no aeration was provided during the tests.

Small bighead carp and goldfish were purchased from the Ozark Catfisheries, Osage Beach, Missouri. Small silver carp were captured from a backwater of the Illinois River near Havana, Illinois, with the aid of Mark Pegg, Illinois Natural History Survey. Large silver carp and bighead carp were captured from the Missouri River near Hartsburg, Missouri. Fish were transported to Columbia Missouri in a live-car equipped with oxygen injection, and released into 700 m^2 ponds, where they were allowed to acclimate for at least two days prior to the test. Table 2 gives the sizes of the fish used in the various periods.

Test containers were 1000L high-density polyethylene cattle tanks. Except for one treatment in the second period specified above, the tanks were shaded from the sun. Temperature in the tanks was measured every 30 minutes by means of a temperature-logging device. Volume of water was 1000 L in all treatments except treatments 1, 2, and 3 in the third period, (small fish in CSSC water) when the volume of water was 850 L. The smaller volume of water was used because of a limited supply of CSSC water.

The water used in periods 1 and 2 and in some treatments in period 3 was Columbia Environmental Research Center (CERC) well water diluted with deionized water to mimic the alkalinity and conductivity of CSSC water. The pH of the reconstituted water was adjusted to between 7 and 7.5 by addition of hydrochloric acid or sodium hydroxide. Reconstituted water was made up 24 hours in advance and final adjustments were then made on the day of the test. No effort to readjust pH was made once the tests had begun. The concentration of dissolved iron in the reconstituted water was determined by atomic absorption spectrophotometry.

CSSC water was collected from the canal and transported to Columbia Missouri in a 2000 gallon water hauling truck. The truck was thoroughly rinsed on the inside using CERC well water prior to the leaving Columbia. The truck was filled with CSSC water at the electric barrier site in Romeoville Illinois on 10/24/03. Dissolved oxygen concentration in the CSSC water at the time of collection was 2.5 mg/L. The dissolved oxygen concentration increased during the trip to Columbia Missouri, presumably because of agitation during transportation. Dissolved oxygen concentration in the CSSC water was 7.4 mg/L after offloading into the test containers on the evening of 10/24/03. The inside of the hauling container was treated with undiluted bleach after offloading the CSSC water to eliminate the potential for translocation of any exotic species, including zebra mussels. Likewise, after completion of the toxicity test, bleach was added to all tanks containing CSSC water or any tank containing piscicides prior to dumping. This served not only to destroy potential exotic species, but also to detoxify the piscicides. The tanks were left to stand with bleach for at least four hours prior to dumping.

Rotenone concentrations in test chambers were prepared by first preparing a stock dilution of Prenfish® 5% rotenone technical grade solution (Prentiss Incorporated, C.B. 2000, Floral Park, New York) mixed in deionized water. A predetermined amount of this stock solution was added to each tank to arrive at the correct final concentration.

The technical grade of antimycin *a* used in this study is a 23% w/w (20% w/v) solution (Fintrol®concentrate, Aquabiotics Incorporated, Bainbridge Island, Washington). Other ingredients in this solution are acetone and soy lipids. Fintrol is packaged with a "Fintrol Diluent" consisting of acetone, a detergent, and a surfactant. This diluent is an aid to dissolving the concentrate in water. We did not use the Fintrol diluent in this study. Instead, we followed the method of Burress (1975) and made a stock dilution of Fintrol in acetone without the detergent carrier. In period 2, we made a stock dilution of Fintrol by drawing an aliquot from the amber bottle of technical grade solution and injecting the aliquot into a volumetric flask. The flask was then filled with unadulterated acetone. At that time, we noted that a droplet of oil, apparently incompletely dissolved in the technical grade solution, was clinging to the pipette tip used to draw the aliquot. Toxicity to Asian carp in the period 2 test was somewhat lower than we expected, so we investigated the possibility that antimycin *a* might have partitioned unequally into undissolved lipids in the technical solution, resulting in lowered toxicity. In period 3, we emptied the entire contents of the technical grade solution into a graduated cylinder to measure the remaining volume. About 10 mL of undissolved lipids (in 222 mL total volume of solution) were noted. This entire volume was then rinsed into a volumetric flask with acetone and all lipids were thoroughly dissolved by mixing. This solution was then used to make up the stock solution, as in period 2.

Temperature in the tanks was recorded at half-hour intervals during the test by the use of temperature logging devices (Tidbit® loggers, Onset Computer, Inc). Dissolved oxygen concentrations were measured at 24-hour intervals with a Yellow Springs Instruments multi-parameter probe. The pH of the tanks was recorded at 24-hour intervals with an Orion hand-held pH meter. The dissolved oxygen probe and the pH meter were calibrated each day prior to measurement.

Mortality was recorded at 15 minutes, 30 minutes, 1 hour, 2 hours, 4 hours, 8 hours, 12 hours, 16 hours, 20 hours, 24 hours, 32 hours, 40 hours, 48 hours, 72 hours, and 96 hours. Criteria for determination of mortality were absence of any respiratory movement and lack of a response to gentle prodding. Fish that were alive but incapable maintaining normal body orientation and incapable of swimming when prodded were termed "morbid". Dead fish were removed and weighed and measured immediately.

Analytical confirmation of rotenone concentrations was performed by the high performance liquid chromatography (HPLC) after the method of Dawson et al. (1983). Grab samples were taken from the test chambers by filling an amber glass bottle directly from the test chamber and capping with a Teflon® closure. In period 1, samples were taken from all treatments one half hour after mixing the rotenone into the tanks, just before addition of the fish. Grab samples were also taken from two treatments at 24, 48, 72, and 96 hours. On two occasions, duplicate grab samples were taken. In period 3, grab samples were taken from two treatments at the start of the test. Grab samples were stored refrigerated (2°C) until analysis. In addition to the samples taken from the test containers, the concentration of rotenone in the technical grade solution used to make the test concentrations was confirmed by analysis.

There are no established methods for the analysis of antimycin *a* at the low concentrations used for fish control. Aquabiotics Corporation, P.O Box 10576 Bainbridge Island, Washington, performed the confirmation of the antimycin *a* concentration in the technical solution. Two blind dilutions (in acetone) of the technical samples were provided to Aquabiotics Corporation. The flourometric method of Sehgal and Vezina (1967) was used for the analysis. One of the blind samples was prepared similarly to the stock solution in period 2 (prior to

dissolving any remaining lipids in acetone) and the second blind sample was prepared similarly to the stock solution in period 3 (after dissolving remaining lipids in acetone). In lieu of chemical analysis of antimycin concentrations in the test chambers, we used goldfish as a positive control organism. Goldfish toxicity was then compared to established data in the literature. Caged goldfish, introduced at 24 and 48 hours post-dosing, were used to empirically test the degradation rates of antimycin. Mortality of these fish was then compared to mortality in fish placed in the chambers at the start of the test. At the end of the antimycin test (period 2), cages containing live goldfish were moved to a tank containing water with no toxicant. Surviving fish (all species) from both controls and from treatment 9 were also placed in cages and moved to a tank with no toxicant. These caged fish were observed for an additional 24 hours to determine any delayed toxicity.

The concentration of toxicant causing 50% mortality (LC50) at the various time periods was calculated using the Spearman – Karber method. A 10% trim was used if possible, and for data sets in which the 10% trim would not work, we increased the trim up to 30%. Trimming refers removal of the ends of the sigmoidal cumulative relative frequency curve, using the more linear central portion for calculation of the LC50 (Hamilton et al., 1977). For data sets which did not fit the Spearman-Karber model, we used the probit method with Abbot's correction. These methods of developing an LC50 have been in use for many years and are preferred by the Environmental Protection Agency (West, Inc. 1996). We used the program Toxstat (Western EcoSystems Technology, Inc., 2003 Central Avenue, Cheyenne, WY 82001) for LC50 calculations.

Results and Discussion

Analytical confirmation of nominal concentrations

Measured rotenone concentration in Prenfish technical grade solution was very close to the nominal value, but measured rotenone concentrations in samples taken from the test chambers were lower than nominal concentrations (Table 3). Measured concentrations in samples taken at 0.5 hours after dosing the chambers were strongly correlated with nominal values (Fig. 1), but averaged 28% of nominal values. We think this reflects degradation. Goldfish mortality occurred at nominal concentrations that were close to values in the literature. Spike recovery ranged from 84 to 99.5%, with most recoveries over 95%, so poor recovery of rotenone from samples is also not expected to be a reason for these low values.

Chromatograms from the analyses of rotenone in this test (Fig. 2) show peaks at the same loci as two of the rotenone breakdown products reported in Draper et al (1999). They were often higher than the measured rotenone concentrations and likely account for the missing toxicant. Standards for the breakdown products are not commercially available. Because the breakdown products have a structure very similar to rotenone, they should have a similar response on the UV detector. This should provide a close estimate of degradation product concentrations. Measured concentrations of rotenone plus estimated concentrations of breakdown products averaged 70.1% of nominal (Table 3). Measured concentrations taken over time from the same chamber to test for degradation showed no real pattern and were highly variable (Fig. 3), but if degradation was continuing in the stored bottles (which were held in the dark at 2°C) one would not expect such a pattern to be detectable.

The single treatment of rotenone in CSSC water was the lowest in recoverable rotenone. This could be due to sorption to solids and organics present in CSSC water. Rotenone and antimycin are easily adsorbed to silts and suspended solids (Illinois Natural History Survey 1975). CSSC water contained significant amounts of suspended solids. This had settled to the

bottom of the chambers by the time toxicants were added, but it was resuspended temporarily during mixing of the toxicants into the test chambers.

The measured antimycin concentrations in blind samples made from the Fintrol technical solution were very close to the nominal concentration, both in the sample with dissolved and undissolved residual lipids (Table 4). The confidence interval encompassed the nominal concentration on Blind B, in which the lipids were dissolved. The confidence interval of the measured concentration fell just above the nominal concentration in Blind A. Thus, there is no evidence that test concentrations were lower than nominal concentrations due to partitioning into the undissolved lipid fraction. The Merck Index (Budavari et al, 1989) describes antimycin *a* as "freely soluble in acetone", but gives no lipid solubility.

Water Quality

Temperature, pH, dissolved oxygen and dissolved iron are water quality variables that are important in understanding the effects of these toxicants. Antimycin degrades rapidly at pH > 8 (Marking and Dawson, 1972), so tracking pH throughout the test was important. Antimycin and rotenone degrade faster in higher temperature water, but they are more effective, probably because higher temperatures increase the metabolism and respiration rate of the fish, thereby increasing the rate of toxicant uptake (Berry and Larkin 1954). Dissolved iron strongly binds free antimycin, reducing the effectiveness of the compound (Schnick, 1974). Dissolved oxygen concentrations are important in any test with fish, because fish cannot survive low dissolved oxygen concentrations. In addition, both the toxicants degraded to non-toxic or less toxic byproducts by oxidation.

The pH of the reconstituted water (but not CSSC water) was adjusted to between 7 and 7.5 prior to the test, and pH values varied only slightly through the tests. CSSC water generally varies between these pH values, (data from Metropolitan Water Reclamation District of Greater Chicago) but the pH values of CSSC water brought from the CSSC to Columbia were slightly higher before the start of the test (between 7.54 and 7.66). In period 1 (rotenone test with small fish) pH values varied between 7.13 and 7.65 during the test. In period 2 (antimycin test with small fish) pH values varied between 7.34 and 7.79. In period 3, (confirmatory tests with large and small fish) pH values in reconstituted water ranged from 7.11 to 7.46, and in CSSC water ranged from 7.11 to 7.69. Tanks with large fish had the lowest pH values, undoubtedly due to respiration.

Temperature varied during the test according to the outside temperature, as it would in a field application of toxicant. In periods 1 and 2, all tests were performed under a canopy with shade-cloth walling. Because conditions were similar between tanks, temperature in the tanks varied together over time. In period 1, mean temperature was 15.4 °C over the 96 hours of the test, but gradually decreased from a high of 18 °C at the beginning of the test (Fig. 4). Because of the need to remove bighead and silver carp quickly to avoid a long duration of field application of chemical, managers will be most concerned about the temperature at the beginning of the test. Temperature during the first 8 hours of the test decreased from 18 to 17C. Temperature in period 2 was much lower than in period 1, and there was a warming trend during the 96 hours (Fig. 4). Temperature during the first 8 hours ranged from 9.8 to 11.6 °C. In period 3, CSSC water treatments were performed in an uninsulated building (Fig 4) whereas reconstituted water treatments were performed under the canopy (Fig 4). Mean water temperature in the CSSC water was 12.5 °C over the duration of the test, ranging from 11.17 – 13.99°C, and ranging from 12.2 to 12.0 °C over the first eight hours. Mean temperature in the reconstituted water test during period 3 was also 12.5 °C , but the range was slightly larger (Fig. 4).

Concentrations of dissolved iron in CSSC water are ranged from 0.01 to 0.1 mg/L in 2002 and 2003 (data from Metropolitan Water Reclamation District of Greater Chicago). Concentration of dissolved iron in the reconstituted water was less than 0.01, and was not adjusted to match CSSC water. The CSSC is often very low in dissolved oxygen, which may account for elevated iron concentrations. Iron is not highly soluble in water high in oxygen. It would not have been feasible to lower the dissolved oxygen in the test in order to achieve higher dissolved iron concentrations, because the test organisms require oxygen.

Dissolved oxygen was more than adequate in all treatments with small fish, remaining above 7.5 mg/L at all times. Dissolved oxygen in the CSSC water was low (2.5 mg/L) at the time of collection at the canal, but it was aerated by sloshing during transportation and was at 7.6 mg/L when transferred to the test chambers. Dissolved oxygen in treatments with large fish in reconstituted water was adequate (above 5 mg/L) for the 40-hour duration of that test. Dissolved oxygen concentrations in treatments with large fish in CSSC water dropped as low as 0.6 mg/L by 24 hours, resulting in mortality of test fish in both the control and antimycin chambers. CSSC water is largely composed of wastewater from Chicago, therefore it is very high in biological oxygen demand. This, coupled with the oxygen demand of the large fish and the long time to death when treated with antimycin, resulted in oxygen concentrations that were insufficient to support the fish. However, all large fish subjected to antimycin were alive at the 20 hour period, indicating that antimycin at the test concentrations would not be a suitable chemical for rapid removal of bighead and silver carp.

Behavior of fishes in the toxicity tests

Regardless of toxicant or test concentration, fish of all three species schooled together and there was no obvious intra- or inter-species aggression. Fish were observed coughing after they were introduced into the 1000 and 500 μg rotenone/L test chambers. Otherwise, there were no obvious immediate reactions to either toxicant. Fish did not swim rapidly or try to jump from the test chambers when introduced to higher concentrations of either toxicant. As fish succumbed to the toxicants, they became more lethargic and eventually moribund, but rarely or never showed any sign of struggling or thrashing. Some goldfish floated at the surface when they were moribund or dead, but bighead and silver carp, with few exceptions, remained on the bottom or sank when they died. Assuming that this behavior is similar during field applications, most bighead and silver carp that die or become moribund will not be visible to field personnel until gas buildup in the peritoneal cavity resulting from decomposition raises the fish to the surface.

Sensitivity of test organisms to rotenone

Bighead carp and silver carp were sensitive to rotenone. At nominal concentrations of 15 ug/L and above, both bighead and silver carp were either dead or moribund at 4 hours, all silver carp were dead at 8 hours, and all bighead carp were dead at 12 hours. Control survival of bighead carp was 100%. One of ten silver carp in the control died at the last measurement period, apparently due to fin rot. No other individuals in any concentration showed evidence of fin rot. Figure 5 and Table 5 show the LC50s and the concentrations that caused complete mortality of bighead and silver carp at the various time periods. Marking and Bills (1981) reported 96-hour LC50s for bighead and silver carp in static tests (2.2μg/L , 95% CI 1.7 - 2.7 and 2.8 μg/L, CI 1.9 – 4.0, respectively). We could not calculate a 96-hour LC50 for bighead carp because of high mortality in our lowest concentrations, but the silver carp 96-hour LC50 in this study was very similar (3.6 μg/L, CI 0.1 – 7.5) to the Marking and Bills (1981) study. Marking and Bills (1981) did not report water quality information, the size of the fish in the tests, mortality at earlier time periods, complete mortality at any time period, or the test temperature, which makes further comparisons difficult. In an unpublished report, Henderson (1975) reported complete mortality

of bighead and silver carp in static tests in 6 hours at 30 ug/L and at 10 μg/L, and at 24 hours at 5 μg/L, which indicates toxicity slightly higher than we report here. Henderson did not report the number or size of the fish used, but the fish were undoubtedly small because the test chambers were 20-gallon aquaria. Henderson also did not report the temperature or water quality in the test, but he did mention difficulty in measurement of tiny quantities of the powdered rotenone used.

Marking and Bills (1976) tested the toxicity of rotenone on a variety of fishes under varying conditions. Comparing the 24 hr LC50s of bighead and silver carp in this test to the data of Marking and Bills (1976), bighead and silver carp were less sensitive than bowfin, coho or chinook salmon, rainbow, brook, or lake trout, northern pike, longnose or white sucker, or walleye. They were more sensitive than fathead minnows, goldfish, channel catfish, black bullhead, green sunfish, or largemouth bass. Yellow perch, smallmouth bass, bluegill, and common carp LC50s fell between the LC50s of bighead and silver carp.

Goldfish were much less sensitive to rotenone than bighead and silver carp. Goldfish at nominal concentrations of 250 ug/L and above were dead or moribund at 4 hours and were dead at 8 hours. Some goldfish were alive in the 15ug/L treatment at the 72-hour measurement, but were finally dead by 96 hours (the end of the test). LC50s for the various time periods are given in Table 5. Three of ten goldfish died in the control by the end of the test; none of these fish showed signs of external lesions, but there may have been some incidental mortality of goldfish. The 96-hour LC50 for goldfish in this test was 7 μg/L, compared to 24 μg/L in Marking and Bills (1976). The temperature of the Marking and Bills study was lower than ours, which probably accounts for some of the difference in the goldfish LC50.

Large bighead and silver carp subjected to 50 μg rotenone/L in reconstituted water were reasonably similar in sensitivity to the small fish. All large fish subjected to rotenone were dead or moribund by 4 hours and dead by 8 hours. Control survival was 100% to 40 hours, when the test with large fish with rotenone was terminated.

Small fish subjected to 50 μg rotenone/L in CSSC water (period 3) were moribund at 4 hours but no deaths occurred until the 8-hour observation, by which time all bighead and silver carp were dead. All goldfish were dead by 48 hours. There was no apparent difference in toxicity between the tests conducted in reconstituted water and those conducted in CSSC water, despite the cooler temperatures under which the CSSC test was conducted. Control survival of small fish in CSSC water was 100%, all species.

Sensitivity of test organisms to antimycin *a*

Antimycin *a* is often more toxic than rotenone to fish, but in this study antimycin (as active ingredient) was not as effective at killing Asian carp as rotenone. In general, effective contact time for rotenone is longer than the contact time for antimycin, but fishes exposed to rotenone exhibit physiological responses earlier. In a study by Gilderhus (1972), fish that had become lethargic due to exposure to rotenone recovered when returned to water without toxicant, but fishes exposed to antimycin that had begun to show signs of distress did not recover when released to toxicant-free water. In our study, fairly high dosages of antimycin failed to kill bighead and silver carp within a reasonable period of time. The highest dose tested (20 μg/L) did not kill all silver carp until the 24-hr observation, and did not kill all bighead carp until the 32-hr observation. 96-hr LC50s for bighead and silver carp in this study were 4.6 and 6.3 μg/L antimycin. Figure 6 and Table 7 give the LC50 and 100% mortality data for antimycin from this study. Control survival was 100%, all species, in both the reconstituted water control and the reconstituted water with acetone control.

Goldfish sensitivity to antimycin was similar to that reported in some other studies and differed somewhat from others. Berger et al (1969) reported that 10 μg/L of antimycin was

required to kill goldfish at 96 hours. Ten μg/L was also the 96-hour 100% mortality concentration in this study. Temperature and pH strongly affect the toxicity of antimycin to fishes. Antimycin and rotenone degrade slower in lower temperature water, but they are less effective, probably because at lower temperatures the metabolism and respiration rate of the fish decrease, thereby decreasing the rate of toxicant uptake (Berry and Larkin 1954). Marking and Dawson (1972) reported 96-hour LC50s for goldfish ranging from 0.42 μg/L at pH 6 to 29.25 at pH 9.5. In that study, the 96-hour LC50 was 1.22 μg/L at pHs similar to those in this test (pH ~7.25), which is about 20% of the 96-hour LC50 reported in this study (5.7 μg/L), but they did not report the temperature. Marking and Dawson (1972) also reported 96-hour LC50s to goldfish ranging from 0.07 to 0.34 at a temperature of 22C, but they did not report pH values in that portion of the study. Marking and Dawson did not report LC50s for exposures of less than 96 hours or complete kills at any time period. Walker et al (1964) reported 24-hour complete mortality of goldfish at 40 μg/L, higher than any concentration tested in this study.

Dissolution of lipids in the technical grade product prior to making the test dilutions had no apparent affect on toxicity. Silver and bighead carp exposed to 10 μg antimycin/L were all dead at 96 hours regardless of dilution method. The 5μg/L concentration caused partial mortality to silver carp in both periods (33% with undissolved lipids and 30% with dissolved lipids) and caused partial mortality of bighead carp in the test with undissolved lipids, but did not kill bighead carp in the test with dissolved lipids, although some fish were moribund. Control survival was 100%, all species, in both tests. This corresponds to the chemical analyses comparing the two methods of mixing the antimycin. If antimycin had partitioned strongly into the undissolved lipids in the technical solution container, the data would have shown erroneously low sensitivity of fishes to antimycin. It does not appear that this was the case.

The range of sensitivity of fishes to antimycin is known to be quite wide, a fact which has been useful in selective control of fish (Berger et al., 1969). Finlayson et al. (2002) compared values of antimycin and rotenone in the literature and found antimycin to be 50 times as toxic as rotenone to rainbow trout, but half as toxic to black bullhead as rotenone.

A study by Marking and Bills (1981) found the 96-hr LC50s of antimycin to bighead carp and silver carp to be 0.600 (95% CI 0.54 – 0.67) μg/L, and to silver carp to be 0.83 (95%CI 0.71 – 0.97). The LC50 values in our study are more than 5 times higher. The conditions of that test (water quality, temperature, test chambers, lighting conditions, whether technical or reagent-grade chemical was used, whether or not dispersants or detergents were used to dissolve the antimycin, and the size of the fish) were not reported, nor were analytical or bioassay support of nominal concentrations performed in that test. Thus it is difficult to determine the reason for the difference between their test and ours. Further testing would be required to determine if Asian carp might be more sensitive to antimycin under other conditions.

Caged goldfish were added to some chambers at the 24- and 48-hr intervals in the antimycin test with small fish, to biologically determine degradation of the activity of antimycin. In the 20μg/L treatment, all goldfish added at 24 hours were dead at 96 hours, a time-to-death of 72 hours, which was exactly equivalent to goldfish stocked at zero hour. In the 5 μg/L treatment, one of ten goldfish added at 24 hours was dead at 96 hours (time-to-death 72 hours) compared to three goldfish stocked at the beginning of the test that were dead at the 72 hour observation. Survival in other cages was 100% at the end of the test. Marking and Dawson (1972) developed half-life curves for antimycin at pH 7.5. According to those data, half-life of antimycin in these tests would have been between 93 and 120 hours.

Survival of bighead and silver carp in the 2.5 μg/L antimycin was 100% in 96 hours, in the shaded as well as in the full sunlight treatment. Thus, it is impossible to tell from these data if sunlight degraded the antimycin rapidly enough to reduce toxicity to fishes.

At the end of period 2, remaining fish from the 2.5 and 5 μg/L concentrations were placed in cages and transferred to clean water to observe any delayed mortality. Remaining fish

in cages stocked at 24 hours were also retained for 24 hours in clean water. No further mortality occurred except for one of six fish in the cage containing goldfish from the 5μg/L treatment. Thus, there was no significant delayed mortality of fish exposed to antimycin.

Toxicity of antimycin (7.5 μg/L) to small fish in CSSC water (period 3) was not different from the toxicity we observed in reconstituted water at that concentration. There was no mortality of any fish prior to the 96-hour observation. At 96 hours, 60% of the bighead carp and 20% of the silver carp were dead. No goldfish died in the test. Survival of small fish in the CSSC water control was 100%, all species.

The confirmatory test of antimycin (7.5 μg/L) to large fish in CSSC water failed due to low dissolved oxygen, a result of high fish biomass combined with the biological oxygen demand of CSSC water. No fish had died in any concentration prior to the 24-hour observation, but by that time dissolved oxygen concentrations in those tanks had decreased to values ranging from 0.56 to 3.46 mg/L. Most fish had died by 48 hours, but it was impossible to separate the effects of low dissolved oxygen from the effects of antimycin. Generally, large fish take longer to die from antimycin exposure than small fish (Nick Romeo, Aquabiotics, Inc, personal communication).

The unexpectedly low sensitivity of silver and bighead carp to antimycin in this study may be in part due to the low temperatures during both test periods 2 and 3. Fish must bioaccumulate antimycin from the environment, and reduced metabolism due to low temperatures will delay bioaccumulation and the onset of mortality. However, temperatures were somewhat higher during period 3 than in period 2, and no significant increase in mortality was observed.

Summary

It is our recommendation that the highest allowable concentration of rotenone (250 μg/L) be used to remove Asian carp from the CSSC. We recommend that this concentration be maintained for longer than 4 hours, to allow for a margin of security and ensuring a complete kill. In our study, 250 μg rotenone/L killed all bighead and silver carp in 4 hours. Much lower concentrations (as low as15 μg/L) killed all the bighead carp and 90% of this silver carp in that time period, and the remaining fish were moribund. However, in field applications, mixing will be less complete and fish may avoid the highest concentrations of rotenone. Because of the importance of keeping bighead and silver carp from invading the Great Lakes, and because of the high value of commercial transportation in the CSSC, it is imperative that a complete kill be achieved in the lowest possible time period.

Silver carp and bighead carp were relatively insensitive to antimycin in our study. They were more sensitive than bullhead catfish, but less sensitive than most other species. In both of the two tests in our study, bighead and silver carp were less sensitive than in the single test reported in the literature for those species. The reasons for this difference are not clear. Based on the results of this study, only the highest label recommendations would be advisable for the removal of bighead and silver carp, and those concentrations might require a contact period of more than 24 hours.

References

Berger, B.L., R.E. Lennon, and J.W. Hogan. 1969. Laboratory studies on antimycin *A* as a fish toxicant. Investigations in Fish Control No. 26. U.S. Fish and Wildlife Service. 21pp.

Budavari, S., M.J. O'Neil, A. Smith, and P.E. Heckelman. 1989. Merck Index, 11th edition. Merck Inc., New York, NY. 1606pp plus appendices.

Burress, R.M. 1975. Development and evaluation of on-site toxicity test procedures for fishery investigations. Investigations in Fish Control No. 68. U.S. Fish and Wildlife Service. 7pp.

Berry, G. and P.A. Larkin. 1954. Field trials with "Fish-Tox" in streams. Canadian Fish Culturist 15:10-15.

Dawson, V. K., P.D. Harman, D.P. Schultz and J.L. Allen. 1983. Rapid Method for Measuring Rotenone in Water at Piscicidal Concentrations. Transaction of the American Fisheries Society 112: 725-727.

Draper, W.M. J.S. Dhoot, and S.K. Perera. 1999. Determination of rotenoids and piperonyl butoxide in water, sediments, and piscicide formulations. Journal of Environmental Monitoring 1:519-524.

Finlayson, B.J., R.A. Schnick, R.L. Cailteux, L. DeMong, W.D. Horton, W. McClay, and C.W. Thompson. 2002. Assessment of antimycin *a* use and its potential for reregistration. Fisheries 27:10-18.

Hamilton, M.A., R.C. Russo, and R.V. Thurston. 1977. Trimmed Spearman-Karber method for estimating median lethal concentrations in toxicity bioassays. Environmental Science and Technology 11:714-719.

Henderson, S. 1975. Tolerance of the silver and bighead carp to often used pond treatment chemicals. Arkansas Game and Fish Commission, Little Rock, Arkansas. 5pp.

Howland, R.M. 1969. Interaction of antimycin *a* and rotenone in fish bioassays. The Progressive Fish-Culturist 31:33-34.

Gilderhus P.A. 1972. Exposure time necessary for antimycin and rotenone to eliminate certain freshwater fishes. Journal of the Fisheries Research Board of Canada. 29:109-202

Illinois Natural History Survey. 1975. Chemicals used to control fish and aquatic plants in Illinois. Illinois Institute for Environmental Quality. Chicago, IL. 26pp

Marking, L.L. and V.K. Dawson. 1972. The half-life of biological activity of antimycin determined by fish bioassay. Transactions of the American Fisheries Society 101:100–105.

Marking, L.L. and T.D. Bills. 1981. Sensitivity of four species of carp to selected fish toxicants. North American Journal of Fisheries Management. 1:51-54.

Marking, L.L. and T.D. Bills. 1976. Toxicity of rotenone to fish in standardized laboratory tests. Investigations in Fish Control No. 72. US Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife, US Department of the Interior, Washington, DC. 11 pp.

Marking, L.L. 1973. Critical factors influencing the inactivation of antimycin in water. MS thesis, University of Wisconsin-La Crosse, 32pp.

Schnick, R.A. 1974. A review of the literature on the use of antimycin in fisheries. US Fish and Wildlife Service Bureau of Sport Fisheries and Wildlife, Department of the Interior, La Crosse, WI. 85 pp.

Walker, C.R., R.E. Lennon, and B.L. Berger. 1964. Preliminary Observations on the Toxicity of Antimycin *A* to Fish and Other Aquatic Animals. Investigations in Fish Control, Circular 186, Fish Wildlife Service, U.S.D.I., Washington, D.C. 18 p

Schnick, R.A. 1974. A review of the literature on the use of Antimycin in fisheries. Unpublished report, US Fish and Wildlife Service Fish Control Laboratory. 85pp.

Sehgal, S.H. and C. Vezina. 1967. Automated flourometric analysis of antimycin *a*. Analytical Chemistry 21:266-272.

Table 1. Treatments performed. Unless otherwise specified, each treatment consisted of a round, high-density polyethylene tank containing 1000 L of water. Tanks with "small" fish had ten fish of each species (bighead carp, silver carp, and goldfish). Tanks with "large" fish had two bighead carp and two silver carp. All fish in periods 1 and 2 were "small" fish. "Recon" water was CERC well water mixed with deionized water to approximate the conductivity and alkalinity of Chicago Ship and Sanitary Canal (CSSC) water, and treated with acid or base to a pH between 7 and 7.5, to imitate the normal pH of CSSC water.

Treatment number		**Period 1**			**Period 2**			**Period 3**			
		Water	Rotenone concentration (ug/L)		Water	Antimycin *a* concentration (ug/L)		Water	Fish size	Piscicide	Piscicide Concentration (ug/L)
1		**Recon**	0		**Recon**	0		CSSC*	Small	Control	0
2		Recon	3.25		Recon	0.155		CSSC*	Small	Rotenone	50
3		Recon	7.5		Recon	0.310		CSSC*	Small	Antimycin	7.5
4		Recon	15		Recon	0.625		CSSC	Large	Control	0
5		Recon	31		Recon	1.25		CSSC	Large	Antimycin	7.5
6		Recon	62.5		Recon	2.5		CSSC	Large	Antimycin	7.5
7		Recon	125		Recon	5		CSSC	Large	Antimycin	7.5
8		Recon	250		Recon	10		Recon	Large	Control	0
9		Recon	500		Recon	20		Recon	Large	Rotenone	50
10		Recon	1000		Recon	0 (acetone control)		Recon	Large	Rotenone	50
11					Recon	2.5 (full sunlight)		Recon	Large	Rotenone	50
12								Recon	Large	Rotenone	50
13								Recon	Small	NA	0
14								Recon	Small	Antimycin	10
15								Recon	Small	Antimycin	5
16								Recon	Small	Antimycin	2.5

*Volume of water in these tanks was 850 L. A smaller volume was used with the small fish in CSSC water because with limited availability of CSSC water; this allowed for an additional treatment.

Table 2. Size of fish used in toxicity tests with rotenone and antimycin.

Testing period	"Large" or "small"	Species	Mean Total Length (mm)	Length range (mm)	Length standard deviation	Mean Weight (g)	Weight Range (g)	Weight standard deviation
1	Small	Bighead carp	104	79 - 130	8.29	10.8	4.8 – 20.3	2.80
1	Small	Silver carp	123	91 - 163	11.2	15.8	6.1 – 40.5	4.54
1	Small	Goldfish	105	82 - 126	8.47	14.4	4.4 – 22.3	2.93
2	Small	Bighead carp	104	89 - 126	8.97	11.6	7.2 – 20.4	2.85
2	Small	Silver carp	123	106 - 159	9.53	16.5	9.6 – 39.0	4.76
2	Small	Goldfish	102	80 - 120	9.09	13.8	7.9 – 20.8	3.27
3	Small	Bighead carp	103	86 - 117	7.36	10.8	6.5 – 15.3	2.12
3	Small	Silver carp	122	100 - 156	12.8	16.8	9.8 – 36.4	6.06
3	Small	Goldfish	98.3	58 - 117	15.1	14.1	3.0 – 22.3	4.80
3	Large	Bighead carp	676	605 - 771	58.0	3378	2500 - 5500	900
3	Large	Silver carp	743	706 - 884	72.9	4714	3200 - 6250	1210

Table 3. Measured versus nomimal concentrations of rotenone in test chambers. Samples were from period 1 except for the two 50 µg/L samples, which were taken from period 3. All samples were in reconstituted water made by diluting CERC well water with deionized water and pH adjusting, except for the technical grade product (50,000,000 µg/L) and one of the period 3 samples, which was in Chicago Ship and Sanitary Canal water. Rotenolone and Tephrosin are breakdown products of rotenone. All concentrations are in µg/L (as active ingredient). Solutions were made using Prenfish 5% rotenone technical grade product.

Rotenone Nominal Concentration (µg /L)	**Sampling Time (hr. after addition of toxicant to test chamber)**	**Rotenone Measured Concentration (µg /L)**	**Measured to Nomimal Ratio**	**Rotenone Measured Concentration + Rotenolone and Tephrosin Estimated Concentration (µg /L)**	**Measured to Nomimal Ratio Including Degradation Products**
50,000,000	NA	50,000,000	1	NA	NA
0	0.5	0.0	NA	0.0	NA
3.25	0.5	1.1	0.338	2.9	0.892
7.5	0.5	2.3	0.307	5.2	0.693
15	0.5	3.2	0.213	11	0.753
31	0.5	8.1	0.261	20	0.642
62.5	0.5	22	0.355	45	0.722
125	0.5	52	0.417	90	0.722
250	0.5	42	0.168	163	0.652
250[1]	0.5	47	0.190	190	0.760
500	0.5	88	0.175	329	0.658
500[1]	0.5	62	0.124	434	0.868
1000	0.5	410	0.410	754	0.754
1000[1]	0.5	610	0.610	1210	1.210
1000[2]	0.5	320	0.320	684	0.684
1000[1,2]	0.5	555	0.555	972	0.972
31	24	7.5	0.242	20	0.655
250	24	43	0.172	162	0.649
250[1]	24	52	0.210	164	0.656
250[2]	24	82	0.328	178	0.713
62.5	48	16	0.258	37	0.586
250	48	87	0.348	163	0.653
62.5	72	11	0.173	35	0.563
250	72	54	0.216	132	0.526
62.5	96	10	0.165	31	0.494
250	96	71	0.285	149	0.594
50[3]	2	12	0.232	37	0.744
50[3,4]	2	5.5	0.110	27	0.538

[1]duplicate analysis
[2]Duplicate sample
[3]Sample from period 3
[4]Dilution water was from the Chicago Ship and Sanitary Canal

Table 4. Concentrations of antimycin *a* in blind samples made from Fintrol® technical solution. Blind A was made by taking an aliquot of the liquid in the original bottle without dissolving residual lipids, then dilution to the "blind" nominal concentration with acetone. Blind B was made by dissolving all lipids by the addition of additional acetone, then diluting the solution to the blind concentration.

	Nominal concentration (% active ingredient, w/v)	**Measured concentration (% active ingredient, w/v)**
Blind A (lipids not dissolved – compares to period 2 dilution)	1.8	2.04 ± 0.10
Blind B (lipids dissolved – compares to period 3 dilution)	1.02	0.98 ± 0.05

Table 5. Rotenone LC50s (calculated lethal concentrations to 50% of the organisms and confidence intervals) and the concentration lethal to 100% of the organisms for bighead and silver carp and goldfish. All values are reported first as rotenone active ingredient (μg/L), with mg/L of the technical grade solution below in parenthesis. Toxicant used for these exposures was Prenfish, a 5% rotenone technical grade product. Unless otherwise indicated, LC50s were calculated using the Spearman-Karber method with a 10% trim. LC50s were not calculable for some time periods.

Time period (hours)	Bighead carp				Silver carp				Goldfish			
	LC50	CI Low[1]	CI High[2]	100%[3]	LC50	CI Low[1]	CI High[2]	100%[3]	LC50	CI Low[1]	CI High[2]	100%[3]
1	707 (14.1)	250 (5)	1000 (20)	NA[4]	311 (6.2)	125 (2.5)	500 (10)	NA	NC[5]	NC	NC	NA
2	328 (6.6)	250 (5)	500 (10)	500 (10)	188 (3.8)	125 (2.5)	250 (5)	500 (10)	NC	NC	NC	NA
4	27.2 (0.5)	15 (0.3)	31 (0.6)	62.5[7] (1.3)	9.9 (0.2)	7.5 (0.2)	15 (0.3)	250[6] (5)	237[8] (4.7)	178 (1.6)	298 (6.0)	500 (10)
8	10.6 (0.2)	7.5 (0.2)	15 (0.3)	62.5[7] (1.3)	8.8 (0.2)	3.25 (0.1)	15 (0.3)	15 (0.3)	178[8] (3.6)	134 (2.6)	224 (4.5)	500 (10)
12	5.8 (0.1)	3.25 (0.1)	7.5 (0.2)	15 (0.3)	7.5 (0.2)	3.25 (0.1)	15 (0.3)	15 (0.3)	99.2[8] (1.9)	63.9 (1.3)	135 (2.7)	250 (5)
16	4.5 (0.1)	3.25 (0.1)	7.5 (0.2)	7.5 (0.2)	7.5 (0.2)	3.25 (0.1)	15 (0.3)	15 (0.3)	112[8] (2.2)	76.9 (1.5)	148 (3.0)	250 (5)
20	4.5 (0.1)	NC	NC	7.5 (0.2)	7.5 (0.2)	NC	NC	15 (0.3)	125[8] (2.5)	89.8 (1.8)	159 (3.2)	250 (5)
24	4.2 (0.1)	NC	NC	7.5 (0.2)	7.5 (0.2)	3.25 (0.1)	15 (0.3)	15 (0.3)	104[8] (2.1)	68.9 (1.4)	140 (2.8)	250 (5)
32	4.2 (0.1)	0.1 (0.002)	7.5 (0.2)	7.5 (0.2)	5.4 (0.1)	0.1 (0.002)	7.5 (0.2)	15 (0.3)	28.4[8] (0.6)	20.0 (0.4)	36.7 (0.7)	62.5 (1.3)
40	NC	NC	NC	7.5 (0.2)	5.4 (0.1)	NC	NC	15 (0.3)	24.6[8] (0.5)	15.5 (0.3)	33.6 (0.6)	62.5 (0.7)
48	NC	NC	NC	7.5 (0.2)	4.6 (0.1)	0.1 (0.002)	7.5 (0.2)	15 (0.3)	18.3[8] (0.4)	11.2 (0.2)	25.4 (0.5)	62.5 (1.3)
72	NC	NC	NC	7.5 (0.2)	3.9 (0.1)	0.1 (0.002)	7.5 (0.2)	7.5 (0.2)	11.1[8] (0.2)	7.31 (0.15)	15.0 (0.30)	31 (0.6)
96	NC	NC	NC	7.5 (0.2)	3.6 (0.1)	0.1 (0.002)	7.5 (0.2)	7.5 (0.2)	6.82[8] (0.14)	4.18 (0.08)	9.46 (0.19)	15 (0.3)

[1]Lower boundary of the 95% confidence interval for the LC50
[2]Upper boundary of the 95% confidence interval for the LC50
[3]Test concentration causing 100% mortality.
[4]NA = Not applicable
[5]NC = Not calculable
[6]At 4 hours all silver carp at concentrations 15 and above were dead, except one fish in 62.5ug/L and one fish at 125 ug/L. These fish were moribund at 4 hours.
[7]One moribund bighead carp alive in each of the 31 and 15 ug/L concentrations. All other fish at concentrations 15 ug/L and above were dead.
[8]Calculated using Probit analysis with Abbot's correction

Table 6. Antimycin LC50s (calculated lethal concentrations to 50% of the organisms) and confidence intervals for bighead and silver carp and goldfish. All values are reported as antimycin, active ingredient. Toxicant used for these exposures was Fintrol,, a 20% antimycin (w/v) technical grade product. To arrive at the concentration as technical grade solution, these data should be multiplied by a factor of 5. Unless otherwise indicated, LC50s were calculated using the Spearman-Karber method with a 10% trim. LC50s were not calculable for some time periods.

Time period (hours)	Bighead carp				Silver carp				Goldfish			
	LC50 (µg/L)	CI Low[1]	CI High[2]	100%[3]	LC50 (µg/L)	CI Low[1]	CI High[2]	100%[3]	LC50 (µg/L)	CI Low[1]	CI High[2]	100%[3]
20	NC[4]	NC	NC	NA[5]	17.1[6]	14.2	20.04	NA	NC	NC	NC	NA
24	16.3	14.3	18.2	NA	15	NC	NC	20	NC	NC	NC	NA
32	14.3	12.6	16.0	20	9.2	6.8	11.67	20	42.5[7]	-8.5637	93.5954	NA
40	8.8	6.3	11.3	20	7.5	NC	NC	10	13.2[7]	-6.8359	33.25	NA
48	7.5	NC	NC	10	7.2	6.5	7.88	10	29.4[7]	12.0134	46.8746	NA
72	7.5	NC	NC	10	7.2	6.5	7.88	10	9.7	6.61	12.88	20
96	4.6	3.4	5.8	10	6.3	4.9	7.63	10	5.7	4.38	7.03	10

[1]Lower boundary of the 95% confidence interval for the LC50
[2]Upper boundary of the 95% confidence interval for the LC50
[3]Lowest test concentration causing 100% mortality.
[4]NC = not calculable
[5]NA = not applicable; no test concentration killed all fish of this species at this time period
[6] a 30% trim was used to calculate this LC50; 10 and 20% trims would not allow calculation of an LC50
[7]Probit analysis was used to calculate these LC50s and associated confidence intervals because the data did not fit the Spearman-Karber model.

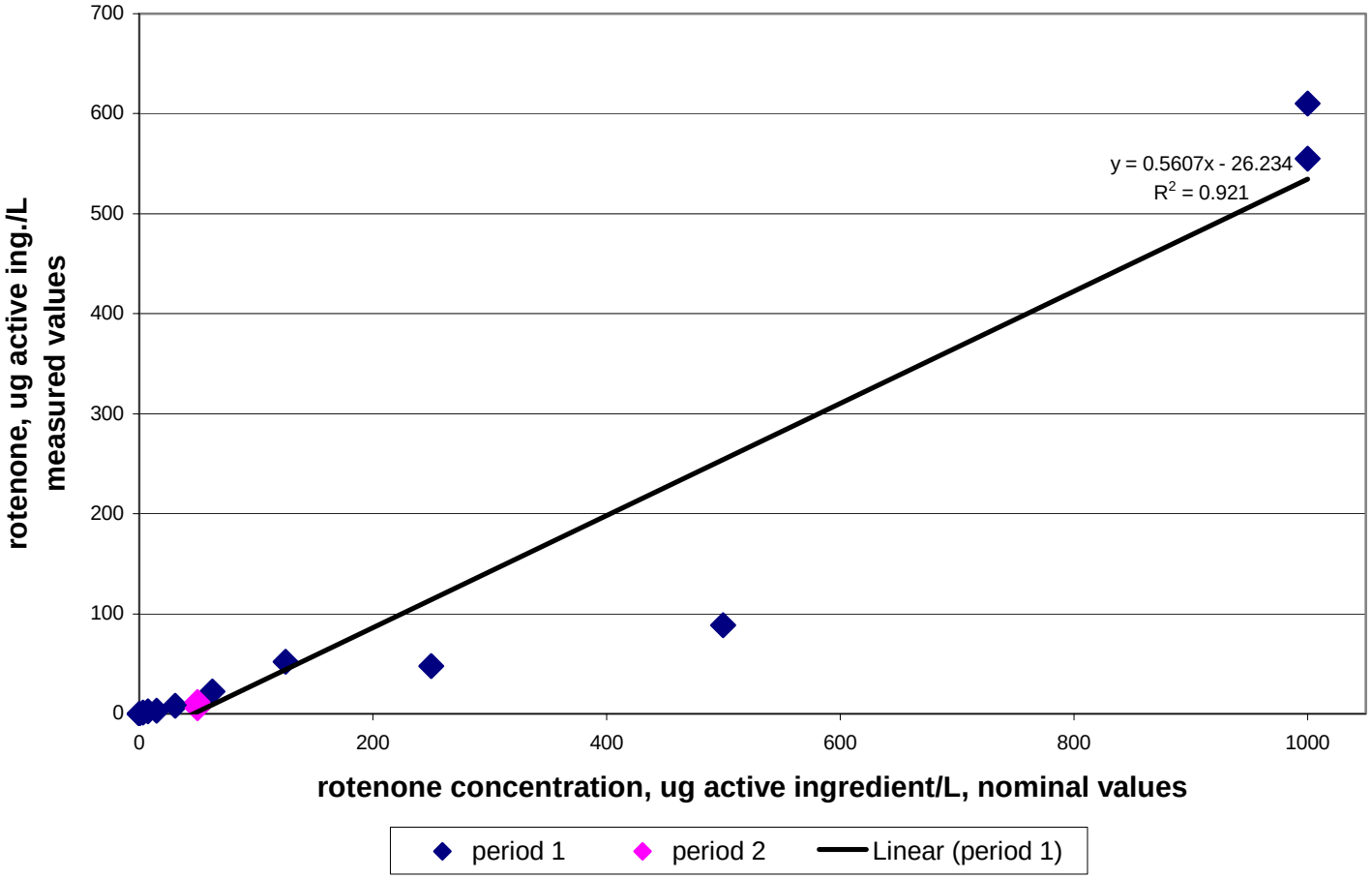


Figure 1. Measured versus nominal concentrations of rotenone in a toxicity test with Asian carp.

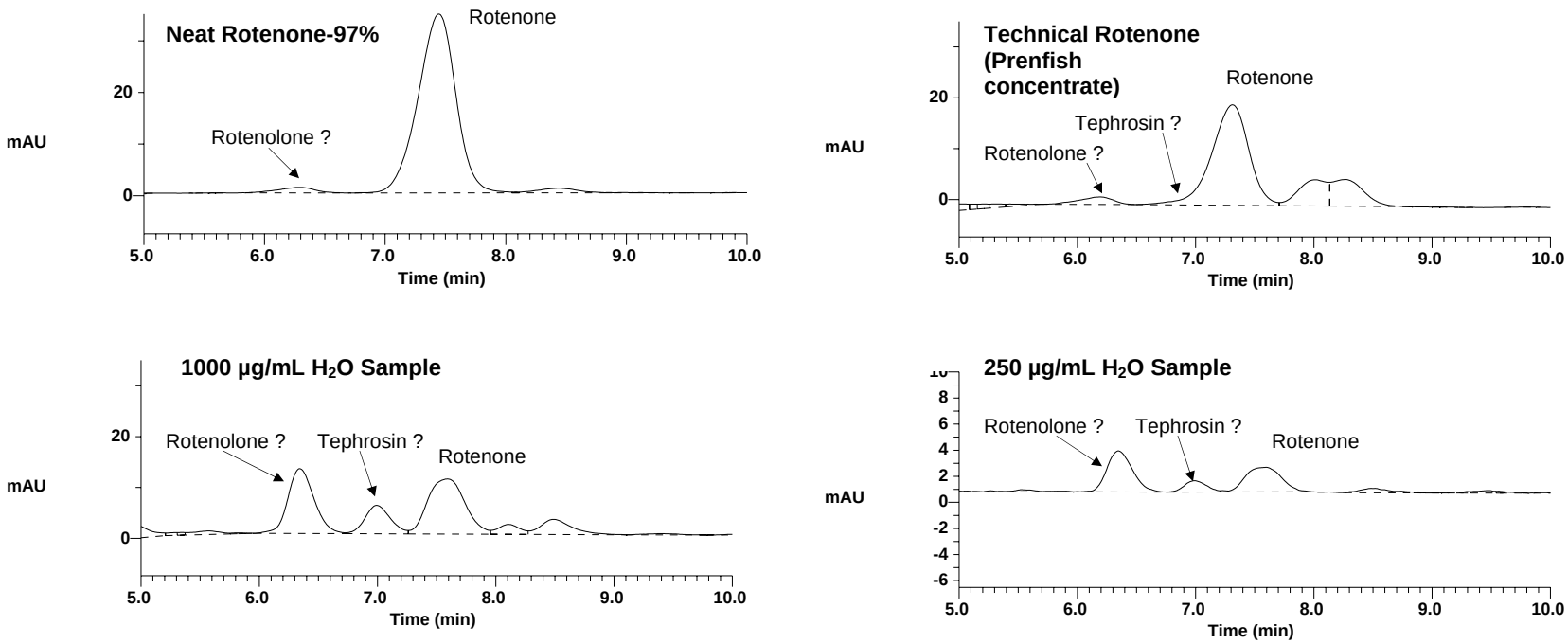


Figure 2. Chromatograms from analysis of rotenone. Peaks to the left of the rotenone peak are situated similarly on the chromatogram to peaks identified by Draper et al. (1999) to be rotenone's breakdown products rotenolone and tephrosin. 1000 and 250 µg/L chromatograms were from samples collected at the start of period 1.

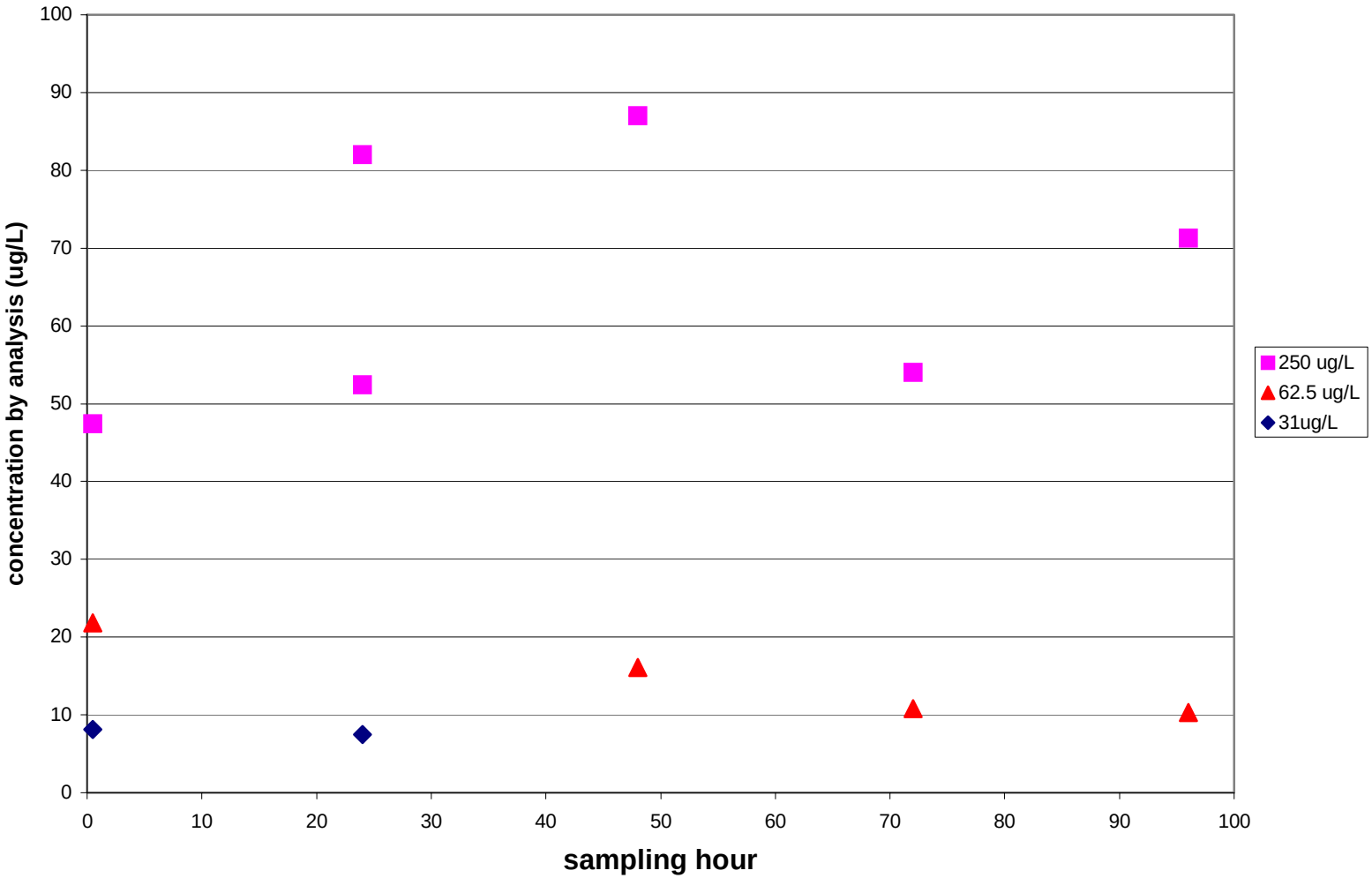


Figure 3. Concentrations of rotenone from samples taken during a toxicity test with Asian carp. All concentrations are as active ingredient.

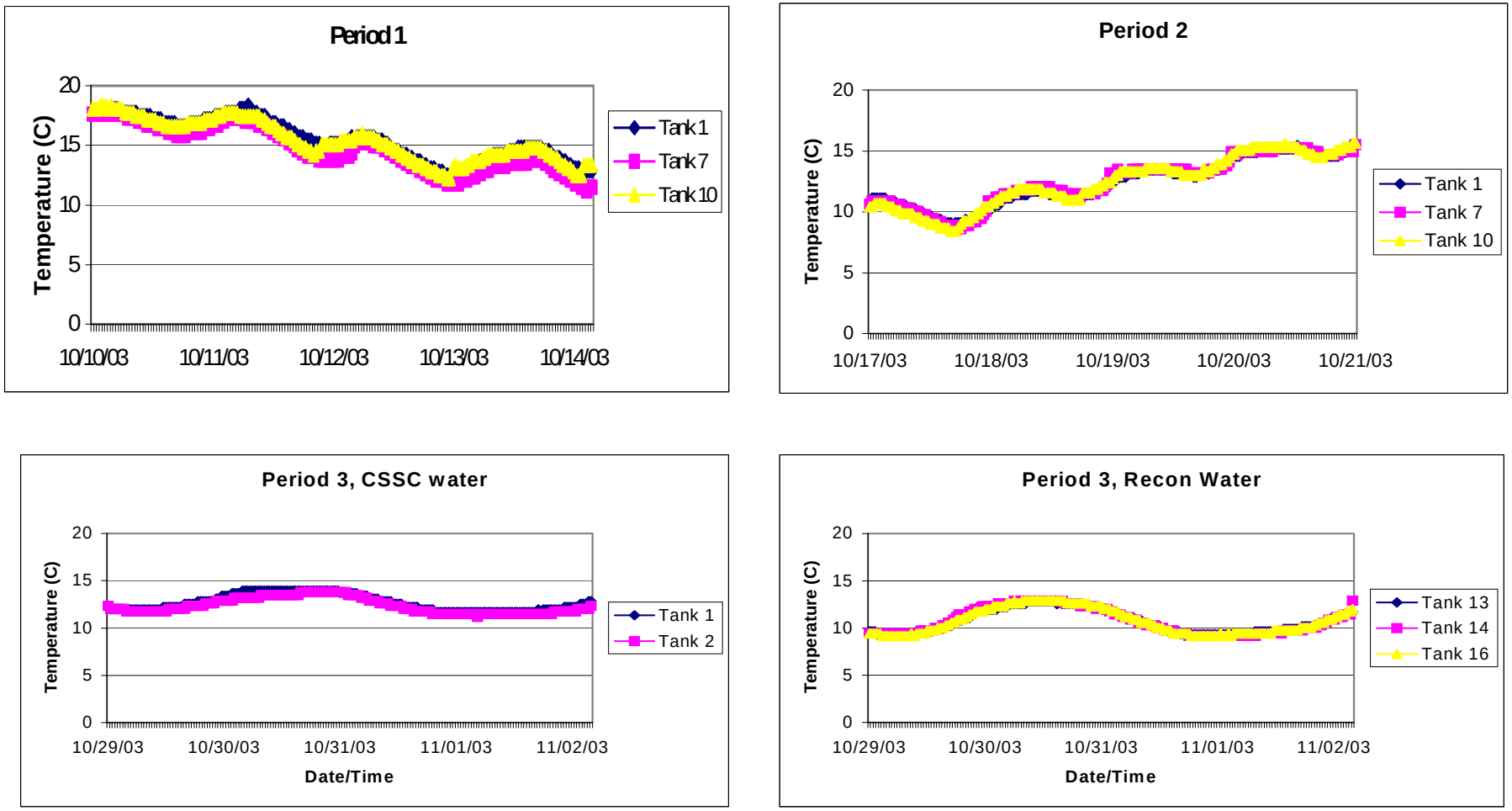


Figure 4. Temperatures of representative test chambers during toxicity tests with Asian carp. All tests were conducted outdoors under a canopy, except for the period 3 test with CSSC water, which was conducted in an uninsulated building.

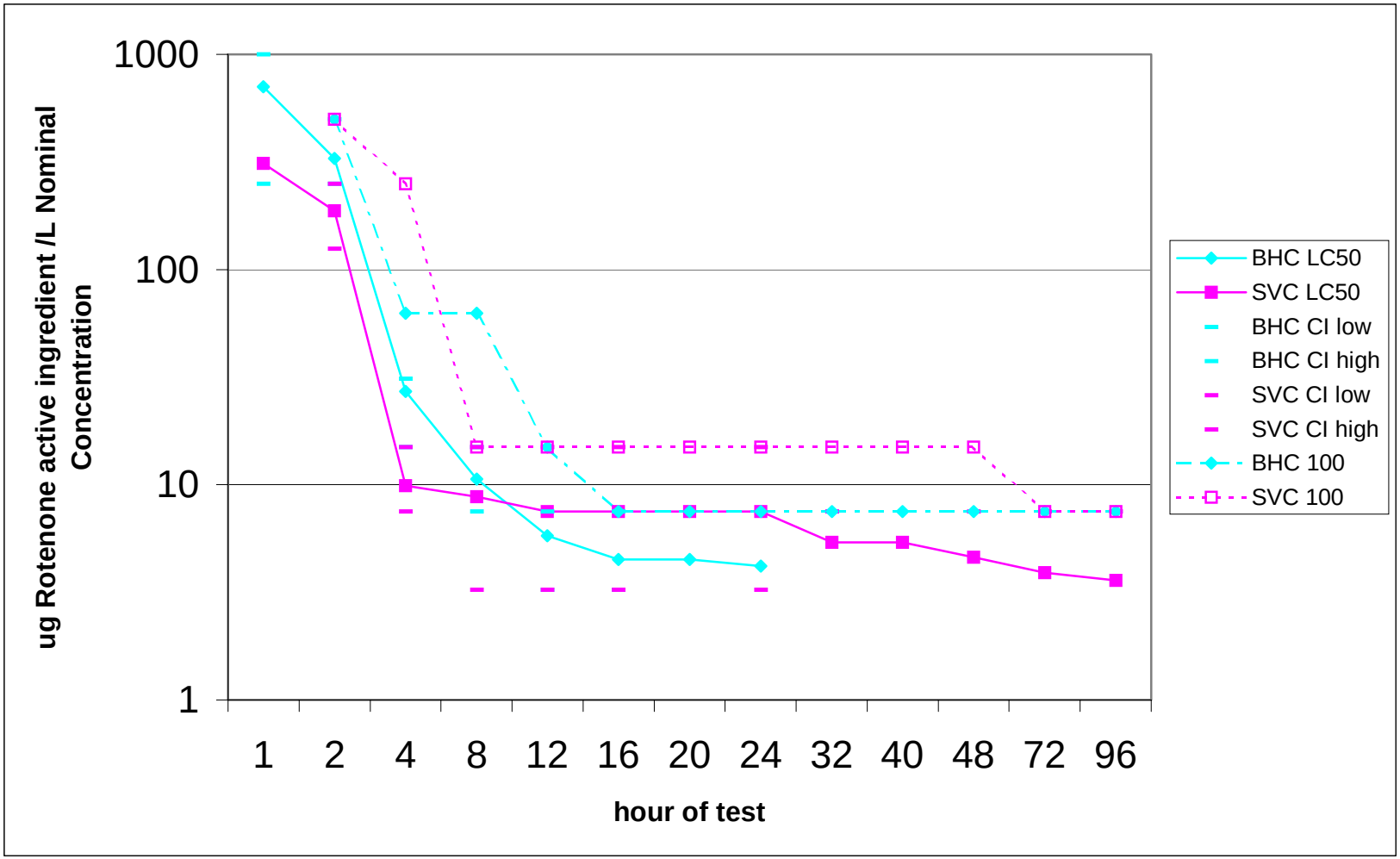


Figure 5. LC50s and confidence intervals and concentrations that caused complete mortality in bighead and silver carp exposed to rotenone. BHC = bighead carp, SVC = silver carp, CI low = low 95% confidence interval value, CI high = high 95% confidence interval value, BHC 100 lowest concentration that killed 100% of bighead carp, and SVC 100 is the lowest concentration that killed 100% of silver carp.

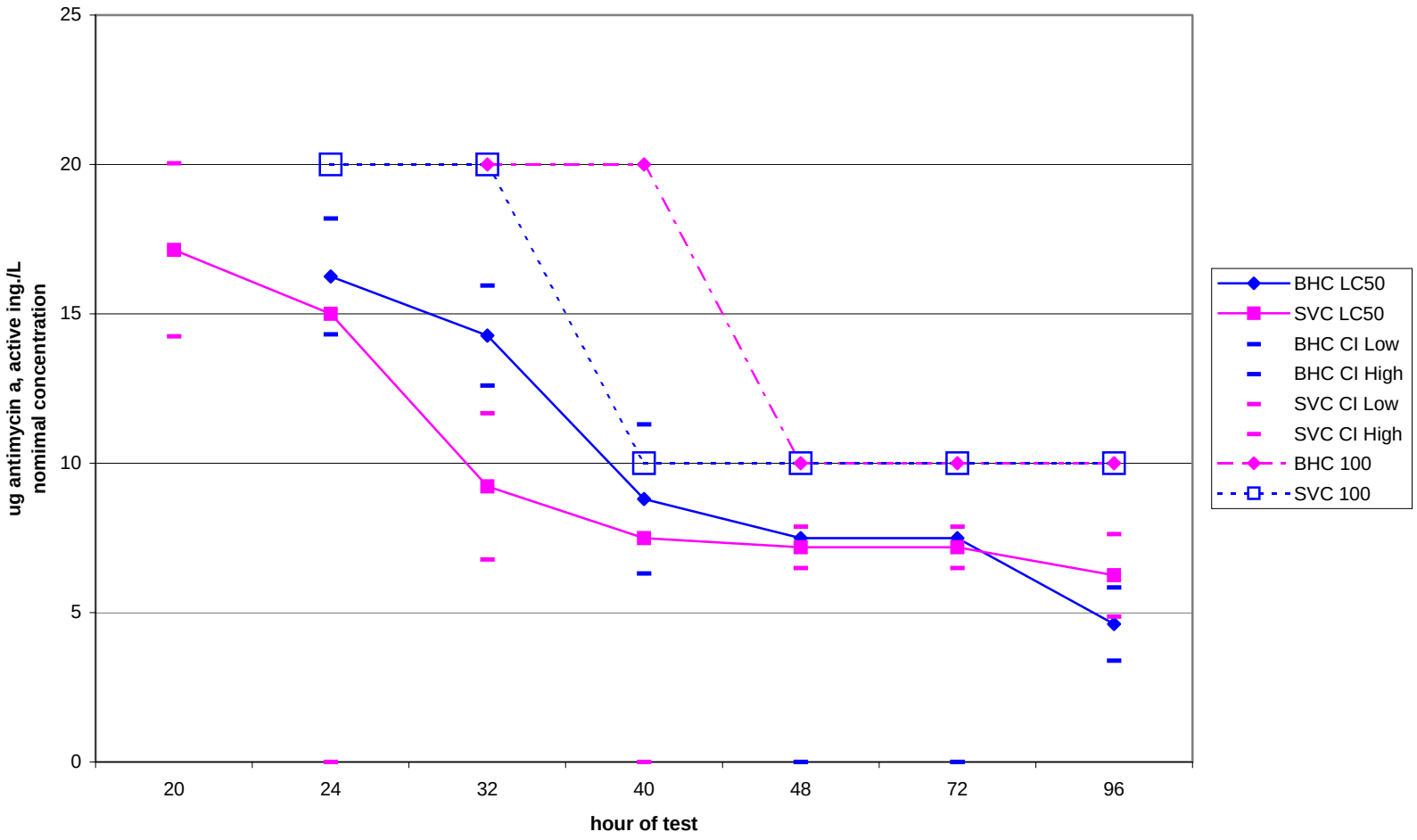


Figure 6. Antimycin LC50s (lethal concentration to 50% of the organisms) and concentrations which killed all organisms at different time periods. BHC = bighead carp, SVC = silver carp, CI low = low 95% confidence interval value, CI high = high 95% confidence interval value, BHC 100 lowest concentration that killed 100% of bighead carp, and SVC 100 is the lowest concentration that killed 100% of silver carp

Appendix K
Lockport Pool Treatment Area Biomass Estimate

APPENDIX K
Lockport Pool Treatment Area Biomass Estimate

There exist no published or gray literature representing standing stock estimate (biomass) studies of fishes within the Chicago Sanitary and Ship Canal (CSSC). The Metropolitan Water Reclamation District of Greater Chicago's report number 98-10 does present data relative to pounds of fish collected during thirty minutes of electrofishing. However, no effort was undertaken to determine species stock estimates. In addition, the principal target species, bighead and silver carp, currently do not occur within the Lockport Lock and Dam Pool.

The potential biomass of fishes that could be eradicated from the canal following the application of the piscicide rotenone will have to be estimated based upon another, similar body of water's standing stock study. Collins Cooling Pond (presently Heidecke Lake), is a 1,955 acre impoundment in Grundy County near Morris, Illinois. The lake is a manmade, partially perched, impoundment with relatively straight, rip-rap shorelines and a relatively constant current (flow). The lake was impounded (1976) utilizing Illinois River water and currently receives its make-up water from the Illinois River. Many species of fish which occur in the CSSC also occurred in Collins Cooling Pond during the early 1980's.

During 1981, researchers from SIU completed standing stock estimates for Collins Cooling Pond based upon small scale rotenone treatments (artificial cove rotenone samples). Biomass data estimates for species common to both Collins and the CSSC will be utilized to estimate the standing stock within the CSSC. Species of fishes known to currently occur in the CSSC and were collected from Collins
Cooling Pond are as follows: Gizzard shad, common carp, yellow bullhead, black bullhead, channel catfish, orangespotted sunfish, green sunfish, bluegill, hybrid sunfish, largemouth bass, yellow bass, goldfish, emerald shiner, bluntnose minnow and golden shiner. Five species which did not occur in Collins during 1981, but will be present in the CSSC in the event of a rotenone application, are the white perch, round goby and Asian Carp (bighead, grass, and silver).

The table below illustrates the pounds per acre by species, which can potentially be expected from the CSSC. Note that estimates for Asian carp and round goby are based in part upon pounds per acre of common carp and tadpole madtom respectively, estimated from Collins Cooling Pond. Data Estimates included in this sampling are from 2004.

Species	Est. Pounds/Acre	Species	Est. Pounds/Acre
Gizzard shad	350	Goldfish	9
Common carp	125	Round goby	15
Lepomis species	9	Bighead carp	125
Catfish/Bullheads	33	Silver carp	125
Basses (Black/Temp)	4	Grass carp	5

Based upon the above criteria, a biomass of 800 pounds per acre can be expected to be present in the CSSC's Lockport Lock and Dam Pool. With a surface area of 141 acres, the potential poundage of fish eradicated could total 112,800 pounds.

Given the uncertainty as to the time of year of the treatment and the potential of other, transient species such as alewife, trout and salmon being present, it is recommended that containers and a dump site capable of holding 200,000 pounds of fish be selected.

References:

Dennsion, S.G. and four coauthors. 1998. A Study of the Fisheries Resources and Water Quality in the Chicago Waterway System 1974-1996. Report No. 98-10, Metropolitan Water Reclamation District of Greater Chicago, Chicago, Illinois

Southern Illinois University. 1982. Sport Fishery Potential of Power Plant Cooling Reservoirs. Research Project 1743, Draft annual report to Electric Power Research Institute, Palo Alto, California.

Appendix L
Detoxification and Neutralization Information

APPENDIX L

Use of Potassium Permanganate

Physical and Chemical Properties:
Chemical name: $KMn0_4$
Formula Weight: 158.03
Specific Gravity: 2.703
Melting Point: Decomposes above 240°C
Heat of Solution: 10.2 kilocalories/moles of water
Bulk Density: 1440-1602 kg/cubic meter
Crystalline Form: Rhombic
Color: Dark Purple

Assay:
Technical Grade: 97% $KMn0_4$
Free-flowing grade: 95% $KMn0_4$
U.S.P. Grade: 99% $KMn0_4$
Reagent Grade: 99% $KMn0_4$
Empirical Formula: K, 24.74%; Mn, 34.76%; 0, 40.50%

History of Use:
Potassium permanganate is one of the most widely used inorganic chemicals in the world. Since its first use in fish culture in the late 1800s, potassium permanganate has been used primarily:

1. As a disinfectant in fish hatcheries for aquatic plants, aquaria, raceways, ponds, and water supplies.
2. For removal of fish parasites.
3. To reduce disease, or as a disease preventive, especially on wounds of fish.
4. For detoxification of fish toxicants such as rotenone and antimycin.
5. For fungus and algae control.
6. For temporary oxygen depletion problems in ponds.

Potassium permanganate has been used for many years as a prophylaxis in fish culture. It is a recognized treatment for control of a variety of external parasites in fish. These treatments span a broad variety of dosage rates and exposure times.

Interactions:
Potassium permanganate is readily decomposed by various reducing substances such as ferrous salts, citrates, oxalates, iodides, and other organic materials. The chemical is decomposed by concentrated sulfuric acid and hydrochloric acid wherein oxygen and chlorine are liberated respectively. Because it is an oxidizing agent, potassium permanganate is incompatible with many substances. Under the right conditions, reactions may produce explosive results.

Potassium permanganate has been used to oxidize and destroy herbicides such as paraquat and diquat in water. $KMn0_4$ has been neutralized in water using citric acid and / or sodium thiosulfate. Because potassium permanganate is a strong oxidizing agent, it has a useful function in fisheries as a detoxicant for such chemicals as rotenone and antimycin.

A discussion of the use of potassium permanganate to detoxify rotenone is provided in the paper "*Rotenone Neutralization Methods*" by Donald L. Archer, which is provided in the following pages.

Detoxification:

In the event that potassium permanganate causes significant mortality downstream in the Brandon Road Pool, citric acid will be added to neutralize the permanganate. A rate of two parts citric acid is required to neutralize three parts permanganate. This will be applied by boat bailer to the surface at a point below the confluence with the Des Plaines River. If required, this procedure could take up to 500 lbs. of citric acid.

Appendix M
Chemical MSDS Information

Citric Acid

Prenfish – Rotenone 5% EC

Potassium Permanganate

Material Safety Data Sheet
Citric Acid, Anhydrous, U.S.P./N.F. (Granular)

ACC# 05200

Section 1 - Chemical Product and Company Identification

MSDS Name: Citric Acid, Anhydrous, U.S.P./N.F. (Granular)
Catalog Numbers: AC405280000, AC405285000, S72836, S72836-1, A940 1, A940 500, A940-1, A940-500, A9401, A940250LB, A940500, A95 3, A95-250LB, A95-3, A9520LB, A953, BP339 500, BP339-500, BP339500, BW3570250, BW3580250, S7299, S782362
Synonyms: 2-Hydroxy-1,2,3-propanetricarboxylic acid.
Company Identification:
Fisher Scientific
1 Reagent Lane
Fair Lawn, NJ 07410
For information, call: 201-796-7100
Emergency Number: 201-796-7100
For CHEMTREC assistance, call: 800-424-9300
For International CHEMTREC assistance, call: 703-527-3887

Section 2 - Composition, Information on Ingredients

CAS#	Chemical Name	Percent	EINECS/ELINCS
77-92-9	Citric acid	99.0	201-069-1

Hazard Symbols: XI
Risk Phrases: 36/37/38

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Appearance: White powder. **Caution!** Causes respiratory tract irritation. May cause digestive tract irritation. Moisture sensitive. Causes severe eye irritation. May cause skin sensitization by skin contact. Causes skin irritation.
Target Organs: None.

Potential Health Effects
Eye: Causes severe eye irritation and possible injury.
Skin: Causes skin irritation. May cause skin sensitization, an allergic reaction, which becomes evident upon re-exposure to this material.
Ingestion: May cause gastrointestinal irritation with nausea, vomiting and diarrhea. Excessive intake of citric acid may cause erosion of the teeth.
Inhalation: Causes respiratory tract irritation.
Chronic: Repeated exposure may cause sensitization dermatitis.

Section 4 - First Aid Measures

Eyes: Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid. Do NOT allow victim to rub or keep eyes closed.
Skin: Flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes. Get medical aid if irritation develops or persists. Wash clothing before reuse.
Ingestion: Do NOT induce vomiting. If victim is conscious and alert, give 2-4 cupfuls of milk or water. Never give anything by mouth to an unconscious person. Get medical aid.
Inhalation: Remove from exposure to fresh air immediately. If breathing is difficult, give oxygen. Get medical aid. Do NOT use mouth-to-mouth resuscitation. If breathing has ceased apply artificial respiration using oxygen and a suitable mechanical device such as a bag and a mask.
Notes to Physician: Treat symptomatically and supportively.

Section 5 - Fire Fighting Measures

General Information: As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion. This material in sufficient quantity and reduced particle size is capable of creating a dust explosion.
Extinguishing Media: Use water spray, dry chemical, carbon dioxide, or chemical foam. Use agent most appropriate to extinguish fire. Do NOT get water inside containers.

Section 6 - Accidental Release Measures

General Information: Use proper personal protective equipment as indicated in Section 8.
Spills/Leaks: Vacuum or sweep up material and place into a suitable disposal container. Very fine particles can cause a fire or explosion. Eliminate all ignition sources. Clean up spills immediately, observing precautions in the Protective Equipment section. Avoid generating dusty conditions. Remove all sources of ignition. Provide ventilation. Spill may be neutralized with lime. Do not get water inside containers.

Section 7 - Handling and Storage

Handling: Wash thoroughly after handling. Use with adequate ventilation. Minimize dust generation and accumulation. Avoid contact with eyes, skin, and clothing. Keep container tightly closed. Avoid ingestion and inhalation. Do not allow contact with water. Keep from contact with moist air and steam.
Storage: Store in a tightly closed container. Store in a cool, dry, well-ventilated area away from incompatible substances. Store protected from moisture.

Section 8 - Exposure Controls, Personal Protection

Engineering Controls: Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use adequate ventilation to keep airborne concentrations low.

Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
Citric acid	none listed	none listed	none listed

OSHA Vacated PELs: Citric acid: No OSHA Vacated PELs are listed for this chemical.
Personal Protective Equipment
Eyes: Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.
Skin: Wear appropriate protective gloves to prevent skin exposure.
Clothing: Wear appropriate protective clothing to prevent skin exposure.
Respirators: Follow the OSHA respirator regulations found in 29CFR 1910.134 or European Standard EN 149. Always use a NIOSH or European Standard EN 149 approved respirator when necessary.

Section 9 - Physical and Chemical Properties

Physical State: Solid
Appearance: White powder
Odor: Odorless.
pH: Not available.
Vapor Pressure: Not available.
Vapor Density: Not available.
Evaporation Rate: Not available.
Viscosity: Not available.
Boiling Point: Not available.
Freezing/Melting Point:153 - 154.5 deg C
Autoignition Temperature: 1850 deg F (1,010.00 deg C)
Flash Point: Not applicable.
Decomposition Temperature: Not available.
NFPA Rating: (estimated) Health: 2; Flammability: 0; Reactivity: 0
Explosion Limits, Lower:.28
Upper: 2.29
Solubility: 59.2% (20°C)
Specific Gravity/Density:1.6650g/cm3
Molecular Formula:C6H8O7
Molecular Weight:192.12

Section 10 - Stability and Reactivity

Chemical Stability: Stable under normal temperatures and pressures.
Conditions to Avoid: Incompatible materials, dust generation, moisture, exposure to moist air or water.
Incompatibilities with Other Materials: Oxidizing agents, sulfides (inorganic, e.g. ferric sulfide, lead sulfide, sodium sulfide), metal nitrates, alkali carbonates, alkalis, potassium tartrate, acetates, bicarbonates.
Hazardous Decomposition Products: Carbon monoxide, irritating and toxic fumes and gases, carbon dioxide.
Hazardous Polymerization: Will not occur.

Section 11 - Toxicological Information

RTECS#:
CAS# 77-92-9: GE7350000
LD50/LC50:
CAS# 77-92-9:
Draize test, rabbit, eye: 750 ug/24H Severe;
Draize test, rabbit, skin: 500 mg/24H Mild;
Oral, mouse: LD50 = 5040 mg/kg;
Oral, rat: LD50 = 3 gm/kg;
Carcinogenicity:
CAS# 77-92-9: Not listed by ACGIH, IARC, NIOSH, NTP, or OSHA.
Epidemiology: No information available.
Teratogenicity: No information available.
Reproductive Effects: No information available.
Neurotoxicity: No information available.
Mutagenicity: No information available.
Other Studies: No data available.

Section 12 - Ecological Information

Ecotoxicity: No data available. Fish toxicity: LC100 goldfish 894 mg/l lifetime exposure in hard water, LD0 goldfish 625 mg/l lifetime exposure in hard water (Ellis,M.M.Detection and measurement of Stream Pollution 1937,22,XLVII,365,US Brit.Fisheries Bull.) Invertebrate toxicity: LD100 Daphnia magna 120 mg/l lifetime exposure in soft water, LD0 Daphnia magna 80 mg/l lifetime exposure in soft water. Toxicity threshold: Pseudomonas putida > 10 g/l; Scenedesmus quadricauda 640 mg/l; Entosiphon sulcatum 485 mg/l (Bringmann,G.et al Water Res. 1980,14,231-241).
Environmental: Nitrification inhibition. Nitrosomonas sp 100 mg/l no inhibition of ammonia oxidation (Hockenbury,M.R. et al J.Water Pollut.Control Fed.1799,49(5),768-777). Degradation studies. 70-100% removal by activated sludge at 20øC for 120 hr (Muto,N.et al Kenkyu Hokuku-Kanto Gakuin Daigaku Kogakubu 1987,31(2),257-266 (Japan)).
Physical: No information available.
Other: BOD5 0.420; BOD20 0.610; ThOD 0.686 mg/l O2 respectively (Meinck,F. et al Les Eaux Residuaires Industrielles 1970). Biodegradable (Ministry of International Trade and Industry (MITI) Report 1984, Japan).

Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.
RCRA P-Series: None listed.
RCRA U-Series: None listed.

Section 14 - Transport Information

	US DOT	IATA	RID/ADR	IMO	Canada TDG
Shipping Name:	No information available.				No information available.
Hazard Class:					
UN Number:					
Packing Group:					

Section 15 - Regulatory Information

US FEDERAL

TSCA
CAS# 77-92-9 is listed on the TSCA inventory.
Health & Safety Reporting List
None of the chemicals are on the Health & Safety Reporting List.
Chemical Test Rules
None of the chemicals in this product are under a Chemical Test Rule.
Section 12b
None of the chemicals are listed under TSCA Section 12b.
TSCA Significant New Use Rule
None of the chemicals in this material have a SNUR under TSCA.
SARA

Section 302 (RQ)
None of the chemicals in this material have an RQ.
Section 302 (TPQ)
None of the chemicals in this product have a TPQ.
SARA Codes
CAS # 77-92-9: acute.
Section 313
No chemicals are reportable under Section 313.
Clean Air Act:
This material does not contain any hazardous air pollutants. This material does not contain any Class 1 Ozone depletors. This material does not contain any Class 2 Ozone depletors.
Clean Water Act:
None of the chemicals in this product are listed as Hazardous Substances under the CWA. None of the chemicals in this product are listed as Priority Pollutants under the CWA. None of the chemicals in this product are listed as Toxic Pollutants under the CWA.
OSHA:
None of the chemicals in this product are considered highly hazardous by OSHA.
STATE
CAS# 77-92-9 is not present on state lists from CA, PA, MN, MA, FL, or NJ.
California No Significant Risk Level: None of the chemicals in this product are listed.

European / International Regulations

European Labeling in Accordance with EC Directives
Hazard Symbols:
XI
Risk Phrases:
R 36/37/38 Irritating to eyes, respiratory system
and skin.

Safety Phrases:
S 26 In case of contact with eyes, rinse immediately

with plenty of water and seek medical advice.
S 37/39 Wear suitable gloves and eye/face protection.

WGK (Water Danger/Protection)
CAS# 77-92-9: 0
Canada
CAS# 77-92-9 is listed on Canada's DSL List. CAS# 77-92-9 is listed on Canada's DSL List.
This product has a WHMIS classification of D2B.
CAS# 77-92-9 is listed on Canada's Ingredient Disclosure List.
Exposure Limits

Section 16 - Additional Information

MSDS Creation Date: 2/09/1999
Revision #3 Date: 2/01/2001

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall Fisher be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if Fisher has been advised of the possibility of such damages.

Material Safety Data Sheet
U.S. Department of Labor (OSHA 29 CFR 1910.1200)

Manufacturer's Name: **Prentiss Incorporated**
C. B. 2000
Floral Park, NY 11001
Telephone Number: **(516) 326-1919**

Section 1: Chemical Identification

Product: 655-422 Prentox® Prenfish™ Toxicant
EPA Signal Word: DANGER

Active Ingredient (%):	Rotenone (5%)	(CAS # 83-79-4)
	Other Cube Resins (10%)	N/A
Chemical Names:	Rotenone – N/A	
Chemical Class:	Mixture	

Section 2: Composition/ Information 0n Ingredients

Material:	OSHA PEL	ACGIH TLV	Other	NTP/IARC/OSHA Carcinogen
Rotenone	(TWA) 5 mg/ M^3	(STEL) 10 mg/M^3 (TWA) 5 mg/M^3		No/No/No
Other associated cube resins	Not Est.	Not Est.		
Aromatic Petroleum Solvent (Supplier recommendation 100 ppm) (CAS # 64742-94-5) (Not to exceed 80%)				
Contains the following ingredients, by weight (typical):				
Naphthalene (CAS # 91-20-3)		9.9%	(TWA) 10 ppm	
1,2,4-trimethylbenzene (CAS # 95-63-6)		1.7%	(TWA) 25 ppm	
Acetone (CAS # 67-64-1) (not to exceed 7.5%)			(TWA) 250 ppm	
Emulsifier #1 (CAS # N/A)		1.5%		N/D
Emulsifier #2 (CAS # N/A)		4.5%		N/D

Section 3: Hazards Identification

Clear liquid with mild odor. Fatal if inhaled. May be fatal if swallowed. Harmful if absorbed through skin. Causes substantial but temporary eye injury. Causes skin irritation. This pesticide is extremely toxic to fish.

Potential Health Effects:

Primary Routes of Entry: Inhalation, ingestion, skin and eye contact.

Health Hazards (Acute and Chronic): Causes mucous membrane irritation. Chronic exposure can cause damage to liver and/or kidneys. May be fatal if swallowed. May cause eye injury. Causes skin irritation. Do not get in eyes, on skin or on clothing. Toxicity of other components: This product contains an aromatic solvent. Inhalation of solvent vapors at high concentrations are irritating to the eyes and respiratory tract, may cause headaches, dizziness, anesthesia, drowsiness, unconsciousness, and other central nervous system effects, including death. Aspiration of solvent during vomiting may cause mild to severe pulmonary injury, possibly progressing to death. Frequent or prolonged skin contact may irritate and cause dermatitis. Skin contact may aggravate an existing dermatitis condition. Emulsifiers may cause severe eye injury.
Signs and Symptoms of Overexposure: Can cause skin irritation. Ingestion or inhalation can cause numbness, nausea, vomiting and tremors.
Medical Conditions Generally Aggravated by Exposure: None known.

Section 4: First Aid Measures

If swallowed, call a physician or Poison Control Center. Do not induce vomiting. This product contains aromatic petroleum solvent. Aspiration may be a hazard. Promptly drink a large quantity of milk, egg white, and gelatin solution, or if these are not available, water. Avoid alcohol.
If inhaled, remove victim to fresh air. If not breathing, administer artificial respiration, preferably by mouth to mouth. Get medical attention.
If on skin, wash with plenty of soap and water. Get medical attention if irritation persists.
If in eyes, flush eyes with plenty of water. Get medical attention if irritation persists.

Section 5: Fire Fighting Measures

Fire and Explosion

Flash Point (Method Used): 60º F. Closed cup.
Flammable Limits: LEL: 1.8 UEL: 11.7 (Solvent - approximate)
NFPA Hazard Ratings: Health: 3 **Flammability:** 4 **Reactivity:** 0
Extinguishing Media: CO_2, foam, dry chemical, or water spray.

Special Fire Fighting Procedures: Do not inhale smoke. Use self-contained breathing apparatus and protective clothing. This product is extremely toxic to fish, and is toxic to birds and other wildlife, prevent spread of contaminated runoff.
Unusual Fire and Explosion Hazards: When heated to decomposition, product emits acrid smoke and fumes.
Flammability Classification/Rating:
NFPA/OSHA Class: I
NFPA Rating (Fire): 4

Section 6: Accidental Release Measures

Wear protective equipment, as required, to prevent contact with product or its vapors. Cover the spilled material with generous amounts of absorbent material, such as clay, diatomaceous earth, sand or sawdust. Sweep the contaminated absorbent onto a shovel and put the sweepings into a salvage drum. Dispose of wastes as below. Place any leaking container into a similar drum or glass container. Mark the drum or container with name of product, ingredient statement, precautionary statements and signal word. Contact us for replacement label. This product is extremely toxic to fish. Fish kills are expected at recommended rates. Keep it out of lakes, streams or ponds except under use conditions.

Section 7: Handling and Storage

Do not contaminate water, food or feed by storage or disposal. Store in a dry place away from temperature extremes. Avoid inhalation of vapors. Harmful if swallowed, inhaled or absorbed through skin. Avoid contact with skin. Wear clean protective clothing.

Other precautions: Periodically inspect stored materials.

Section 8: Exposure Controls/Personal Protection

Respiratory protection: Mixers and handlers: Do not inhale. Use NIOSH certified respirator for organic vapor protection.

Ventilation:

Local Exhaust:	As required to meet TLV.
Special:	Not applicable.
Mechanical:	As required to meet TLV.
Other:	Not applicable.

Protective Gloves: Chemical resistant.

Eye Protection: Safety glasses, face shield or goggles.

Other protective clothing or equipment: Wear long pants, long sleeved shirt or other body covering clothes. Avoid skin or eye contact.

Work/Hygienic practices: Wash thoroughly after handling and before eating or smoking. Remove contaminated clothing and wash thoroughly before reuse.

Section 9: Physical and Chemical Properties

Appearance:	Amber Liquid
Odor:	Aromatic Solvent Odor
Boiling Point:	N/D
Specific Gravity (H_2O = 1):	0.9226
Vapor Pressure (mmHg):	N/D
Melting Point:	N/D
Vapor Density (Air = 1):	N/D
Evaporation Rate (Butyl Acetate = 1):	N/D
Solubility in Water:	Emulsifies.

Section 10: Stability and Reactivity

Stability:	Stable.
Conditions to avoid for stability:	None.
Incompatibility:	Strong acids and oxidizers.
Hazardous Decomposition or Byproducts:	CO, CO_2
Hazardous Polymerization:	Will not occur.
Conditions to avoid for Hazardous Polymerization:	None.

Section 11: Toxicological Information

Acute Toxicity/Irritation Studies:

(The following data were developed with Prenfish)

Ingestion:	Oral LD_{50}	55.3 mg/Kg (Rat – female)
		264 mg/Kg (Rat – male)
		178 mg/Kg (Rat – overall)
Dermal:		>2020 mg/Kg (Rabbit) (Slightly toxic)
Inhalation:		4-hour LC_{50} 0.048 mg/l. (Rat) (Highly toxic)
Eye Contact:		Moderately irritating (Rabbit)
Skin Contact:		Moderately irritating (Rabbit)
Skin Sensitization:		Non-sensitizing (Guinea Pig)

(The following data were developed with rotenone technical)

Mutagenic Potential: Rotenone was not mutagenic when tested.

Reproductive Hazard Potential: Rotenone had no reproductive effects when tested

Chronic/Subchronic Toxicity Studies:

Cancer Information: Rotenone was not carcinogenic when tested in rats and mice.

Toxicity of Other Components:

Petroleum solvent: The supplier reports that inhalation of high vapor concentrations (over 1,000 ppm) may cause nervous system effects such as headaches, dizziness, anesthesia and respiratory tract irritation

Surfactant: Causes severe eye irritation, which could lead to permanent eye damage. Prolonged or repeated skin contact may cause discomfort and local redness. Mist can irritate the respiratory tract, experienced as nasal discomfort and discharge with chest pain and coughing.

Target Organs: Eyes, skin, respiratory tract.

Section 12: Ecological Information

Summary of Effects: This product is extremely toxic to fish. Fish kills are expected at recommended rates. Consult your State Fish and Game Agency before applying this product to public waters to determine if a permit is needed for such an application. Do not contaminate untreated water when disposing of equipment washwaters.

Section 13: Disposal Considerations

Disposal: Wastes resulting from the use of this product may be disposed of on site or at an approved waste disposal facility. Pesticide wastes are toxic. Improper disposal of excess pesticide, spray mixture, or rinsate is a violation of Federal Law. If these wastes cannot be disposed of by use according to label instructions, contact your State Pesticide or Environmental Control Agency, or the Hazardous Waste representative at the nearest EPA Regional Office for guidance.

Container disposal: Triple rinse (or equivalent). Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or by other procedures approved by State and local authorities.

Section 14: Transport Information

DOT Classification: Pesticide liquid, flammable, toxic, n.o.s. (Acetone, Rotenone)
Hazard Class: 3, PG I
Subsidiary hazard class: 6.1
DOT Shipping Label: Poison and/or Toxic

Note: For transport purposes (49FR Part 173.132), the calculated 1-hour LC50 (Rat) is: 0.192 mg/L

Section 15: Regulatory Information

SARA Title III Classification:

Section 311/312:

Acute health hazard
Fire hazard

Section 313 Chemicals:

Aromatic Petroleum Solvent (Supplier recommendation 100 ppm) (CAS # 64742-94-5)
(Not to exceed 80%)
Contains the following ingredients, by weight (typical):

Naphthalene (CAS # 91-20-3)	9.9%	(TWA) 10 ppm
1,2,4-trimethylbenzene (CAS # 95-63-6)	1.7%	(TWA) 25 ppm

This product contains a toxic chemical or chemicals subject to the reporting requirements of Section 313 of Title III and of 40 CFR 372. Any copies or redistribution of this MSDS <u>must</u> include this notice.

Proposition 65: This product does not contain any chemical which is known to the State of California to cause cancer or birth defects or other reproductive harm.
CERCLA Reportable Quantity (RQ): None.
RCRA Classification: Ignitable.
TSCA Status: Registered pesticide, exempt from TSCA regulation. All ingredients are on the TSCA inventory.
Other: Rotenone

Illinois toxic substance
Massachusetts Hazardous Substance
New Jersey Special Health Hazardous Substance
Pennsylvania Workplace Hazardous Substance

Acetone

Massachusetts Hazardous Substance
New Jersey Environmental Hazardous Substance
New Jersey Special Health Hazardous Substance
New Jersey Workplace Hazardous Substance
Pennsylvania Workplace Hazardous Substance

Section 16: Other Information

NFPA Hazard Ratings:	**Health:**	3	0	Least
	Flammability:	4	1	Slight
	Reactivity:	0	2	Moderate
			3	High
			4	Severe

Date Prepared: August 10, 2000
Supersedes: February 2, 1994
Reason: Revised Format

The information and recommendations contained herein are based upon data believed to be correct. However, no guarantee or warranty of any kind, expressed or implied, is made with respect to the information contained herein.

Material Safety Data Sheet
U.S. Department of Labor (OSHA 29 CFR 1910.1200)

Manufacturer's Name: **Prentiss Incorporated**
C. B. 2000
Floral Park, NY 11001
Telephone Number: **(516) 326-1919**

Section 1: Chemical Identification

Product: 655-421 Prentox® Synpren-Fish™ Toxicant
EPA Signal Word: DANGER

Active Ingredients (%):	Rotenone (2.5%)	(CAS # 83-79-4)
	Other Cube Resins (5%)	N/A
	Piperonyl Butoxide Technical (2.5%)	(CAS # 51-03-6)
Chemical Names:	Rotenone – N/A	
	Piperonyl Butoxide Technical – (Butylcarbityl) (6-Propylpiperonyl) ether	
Chemical Class:	Mixture, a.i.'s, rotenone and piperonyl butoxide technical	

Section 2: Composition/ Information 0n Ingredients

Material:	OSHA PEL	ACGIH TLV	Other	NTP/IARC/OSHA Carcinogen
Rotenone	(TWA) 5 mg/ M^3	(STEL) 10 mg/M^3 (TWA) 5 mg/M^3		No/No/No
Other associated cube resins	Not Est.	Not Est.		
Piperonyl Butoxide Technical	Not Est.	Not Est.		No/No/No
Xylene Range Aromatic Solvent (CAS # 64742-95-6) (Not to exceed 90%)	Supplier recommendation 100 ppm			

Contains the following ingredients, by weight (typical):

1,2,4-Trimethyl Benzene (CAS # 95-63-6)	32.0	(TWA) 25 ppm
Mixed Xylenes (CAS # 1330-20-7)	3.0	(TWA) 100 ppm
Cumene (CAS # 98-82-8)	1.5	(TWA) 50 ppm
Ethyl Benzene (CAS # 100-41-4)	0.5	(TWA) 100 ppm

Emulsifier #1 (CAS # N/A)	N/D	N/D
Emulsifier #2 (CAS # N/A)	N/D	N/D

Section 3: Hazards Identification

Clear liquid with mild odor. Fatal if inhaled. May be fatal if swallowed. Harmful if absorbed through skin. Causes substantial but temporary eye injury. Causes skin irritation. This pesticide is extremely toxic to fish.

Potential Health Effects:

Primary Routes of Entry: Inhalation, ingestion, skin and eye contact.

Health Hazards (Acute and Chronic): Causes mucous membrane irritation. Chronic exposure can cause damage to liver and/or kidneys. May be fatal if swallowed. May cause eye injury. Causes skin irritation. Do not get in eyes, on skin or on clothing. Toxicity of other components: This product contains a Xylene Range Aromatic Solvent composed of xylenes, ethylbenzenes and aromatic naphtha containing trimethylbenzenes. Inhalation of solvent vapors at high concentrations can cause central nervous system depression, respiratory tract irritation, asphyxiation, cardiac stress, and coma. Exposure to extremely high levels of xylenes may cause kidney or liver damage.
Signs and Symptoms of Overexposure: Can cause skin irritation. Ingestion or inhalation can cause numbness, nausea, vomiting and tremors.
Medical Conditions Generally Aggravated by Exposure: None known.

Section 4: First Aid Measures

If swallowed, call a physician or Poison Control Center. Do not induce vomiting. This product contains aromatic petroleum solvent. Aspiration may be a hazard. Promptly drink a large quantity of milk, egg white, and gelatin solution, or if these are not available, water. Avoid alcohol.
If inhaled, remove victim to fresh air. If not breathing, administer artificial respiration, preferably by mouth to mouth. Get medical attention.
If on skin, wash with plenty of soap and water. Get medical attention if irritation persists.
If in eyes, flush eyes with plenty of water. Get medical attention if irritation persists.

Section 5: Fire Fighting Measures

Fire and Explosion

Flash Point (Method Used): 105º F. Closed cup.
Flammable Limits: LEL: 1.9 UEL: 12.6 (Solvent - approximate)
NFPA Hazard Ratings: **Health:** 2 **Flammability:** 2 **Reactivity:** 0
Extinguishing Media: CO_2, foam, dry chemical, or water spray.
Special Fire Fighting Procedures: Do not inhale smoke. Use self-contained breathing apparatus and protective clothing. This product is extremely toxic to fish, and is toxic to birds and other wildlife, prevent spread of contaminated runoff.
Unusual Fire and Explosion Hazards: When heated to decomposition, product emits acrid smoke and fumes.
Flammability Classification/Rating:
NFPA/OSHA Class: II
NFPA Rating (Fire): 2

Section 6: Accidental Release Measures

Wear protective equipment, as required, to prevent contact with product or its vapors. Cover the spilled material with generous amounts of absorbent material, such as clay, diatomaceous earth, sand or sawdust. Sweep the contaminated absorbent onto a shovel and put the sweepings into a salvage drum. Dispose of wastes as below. Place any leaking container into a similar drum or glass container. Mark the drum or container with name of product, ingredient statement, precautionary statements and signal word. Contact us for replacement label. This product is extremely toxic to fish. Fish kills are expected at recommended rates. Keep it out of lakes, streams or ponds except under use conditions.

Section 7: Handling and Storage

Do not contaminate water, food or feed by storage or disposal. Store in a dry place away from temperature extremes. Avoid inhalation of vapors. Harmful if swallowed, inhaled or absorbed through skin. Avoid contact with skin. Wear clean protective clothing.

Other precautions: Periodically inspect stored materials.

Section 8: Exposure Controls/Personal Protection

Respiratory protection: Mixers and handlers: Do not inhale. Use NIOSH certified respirator for organic vapor protection.

Ventilation:

Local Exhaust:	As required to meet TLV.
Special:	Not applicable.
Mechanical:	As required to meet TLV.
Other:	Not applicable.

Protective Gloves: Chemical resistant.

Eye Protection: Safety glasses, face shield or goggles.

Other protective clothing or equipment: Wear long pants, long sleeved shirt or other body covering clothes. Avoid skin or eye contact.

Work/Hygienic practices: Wash thoroughly after handling and before eating or smoking. Remove contaminated clothing and wash thoroughly before reuse.

Section 9: Physical and Chemical Properties

Appearance:	Amber Liquid
Odor:	Aromatic Solvent Odor
Boiling Point:	N/D
Specific Gravity (H_2O = 1):	0.8964
Vapor Pressure (mmHg):	N/D
Melting Point:	N/D
Vapor Density (Air = 1):	N/D
Evaporation Rate (Butyl Acetate = 1):	N/D
Solubility in Water:	Emulsifies.

Section 10: Stability and Reactivity

Stability:	Stable.
Conditions to avoid for stability:	None.
Incompatibility:	Strong acids and oxidizers.
Hazardous Decomposition or Byproducts:	CO, CO_2
Hazardous Polymerization:	Will not occur.
Conditions to avoid for Hazardous Polymerization:	None.

Section 11: Toxicological Information

Acute Toxicity/Irritation Studies:

(The following data were developed with Synpren-Fish)

Ingestion: Oral LD_{50} 147 mg/Kg (Rat – female) (Moderately toxic)

	704 mg/Kg (Rat – male) (Slightly toxic)
	561 mg/Kg (Rat – overall) (Slightly toxic)
Dermal:	>2020 mg/Kg (Rabbit) (Slightly toxic)
Inhalation:	4-hour LC_{50} 0.041 mg/l. (Female Rat) (Highly toxic)
	4-hour LC_{50} 0.059 mg/l. (Male Rat) (Highly toxic)
	4-hour LC_{50} 0.049 mg/l. (Rat – overall) (Highly toxic)
Eye Contact:	Moderately irritating (Rabbit)
Skin Contact:	Moderately irritating (Rabbit)
Skin Sensitization:	Non-sensitizing (Guinea Pig)

(The following data were developed with rotenone technical and piperonyl butoxide technical)

Mutagenic Potential: Neither ingredient was mutagenic when tested.

Reproductive Hazard Potential: Neither ingredient had reproductive effects when tested

Chronic/Subchronic Toxicity Studies:

Cancer Information: A statistically significant increase in the number of benign liver tumors appeared in mice fed piperonyl butoxide technical at doses which far exceed any anticipated daily human intake. Independent industry toxicology experts who have reviewed the data agree that the findings of the study do not indicate a health risk to human beings.

Rotenone was not carcinogenic when tested in rats and mice.

Toxicity of Other Components:

Petroleum solvent: The supplier reports that inhalation of high vapor concentrations (over 1,000 ppm) may cause nervous system effects such as headaches, dizziness, anesthesia and respiratory tract irritation

Surfactant: Causes severe eye irritation, which could lead to permanent eye damage. Prolonged or repeated skin contact may cause discomfort and local redness. Mist can irritate the respiratory tract, experienced as nasal discomfort and discharge with chest pain and coughing.

Target Organs: Eyes, skin, respiratory tract.

Section 12: Ecological Information

Summary of Effects: This product is extremely toxic to fish. Fish kills are expected at recommended rates. Consult your State Fish and Game Agency before applying this product to public waters to determine if a permit is needed for such an application. Do not contaminate untreated water when disposing of equipment washwaters.

Section 13: Disposal Considerations

Disposal: Wastes resulting from the use of this product may be disposed of on site or at an approved waste disposal facility. Pesticide wastes are toxic. Improper disposal of excess pesticide, spray mixture, or rinsate is a violation of Federal Law. If these wastes cannot be disposed of by use according to label instructions, contact your State Pesticide or Environmental Control Agency, or the Hazardous Waste representative at the nearest EPA Regional Office for guidance.

Container disposal: Triple rinse (or equivalent). Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or by other procedures approved by State and local authorities.

Section 14: Transport Information

DOT Classification: Pesticides, liquid, toxic, flammable, n.o.s. (Rotenone, petroleum naphtha)
Hazard Class: 6.1,PG I
Subsidiary hazard class: 3
DOT Identification Number: UN2903
DOT Shipping Label: Poison and/or Toxic
Note: for transport purposes (49 CFR Part 173.132), the calculated 1-hour LC50 (Rat, overall) is: 0.196 mg/L

Section 15: Regulatory Information

SARA Title III Classification:

Section 311/312:

Acute health hazard
Fire hazard

Section 313 Chemicals:

Piperonyl Butoxide Technical (2.5%)	(CAS # 51-03-6)
Xylene Range Aromatic Solvent (% Conf.)	(CAS # 64742-95-6)

(Not to exceed 90%)

Contains the following SARA listed ingredients, by weight (typical):

1,2,4-Trimethyl Benzene (CAS # 95-63-6)	32.0	(TWA) 25 ppm
Mixed Xylenes (CAS # 1330-20-7)	3.0	(TWA) 100 ppm
Cumene (CAS # 98-82-8)	1.5	(TWA) 50 ppm
Ethyl Benzene (CAS # 100-41-4)	0.5	(TWA) 100 ppm

This product contains a toxic chemical or chemicals subject to the reporting requirements of Section 313 of Title III and of 40 CFR 372. Any copies or redistribution of this MSDS must include this notice.

Proposition 65: This product does not contain any chemical which is known to the State of California to cause cancer or birth defects or other reproductive harm.
CERCLA Reportable Quantity (RQ): None.
RCRA Classification: Ignitable.
TSCA Status: Registered pesticide, exempt from TSCA regulation. All ingredients are on the TSCA inventory.
Other: Rotenone

Illinois toxic substance
Massachusetts Hazardous Substance
New Jersey Special Health Hazardous Substance
Pennsylvania Workplace Hazardous Substance

Section 16: Other Information

NFPA Hazard Ratings:	**Health:**	3	0	Least
	Flammability:	2	1	Slight
	Reactivity:	0	2	Moderate
			3	High
			4	Severe

Date Prepared: September 18, 2000
Supersedes: August 10, 2000
Reason: Revised section 15.

The information and recommendations contained herein are based upon data believed to be correct. However, no guarantee or warranty of any kind, expressed or implied, is made with respect to the information contained herein.

ASTRO PRODUCT CODE # 25081

MATERIAL SAFETY DATA SHEET

Material Name
Potassium Permanganate

Issue Date: 03/10/1995
MSDS No.: BCC-001

Section 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Chemical Name: Potassium Permanganate
Internal Part No.: None

Manufacturer Information
Browning Chemical Corporation
(importer of record)
707 Westchester Avenue
White Plains, New York 10604
----PHONE #: (914) 686-0300
EMERGENCY #: 1-800-424-9300
Mfg. Part #None

Supplier Information
None
----PHONE #:
EMERGENCY #:

Sup. Part #NA

Synonyms: Permanganic acid, potassium salt

NOTE: Emergency telephone numbers are to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure, or accident involving chemicals. All non-emergency questions should be directed to customer service.

Section 2 - COMPOSITION / INFORMATION ON INGREDIENTS

CAS #	Components	% Wt.
7722-64-7	POTASSIUM PERMANGANATE	98

Component Information/Information on Non-Hazardous Components
This product is considered hazardous under 29 CFR 1910.1200 (Hazard Communication).

Section 3 - HAZARDS IDENTIFICATION

Emergency Overview
This product is a dark purple/black solid in crystal/needle form. Fatal if swallowed. Highly corrosive to the skin. Can cause permanent damage to the eyes. Known irritant of the repiratory system. Strong oxidizer. Contact with other combustible material may cause fire. Firefighters should use full protective equipment and clothing.

Label Information
STRONG OXIDIZER. MAY BE FATAL IF SWALLOWED OR INHALED. CAUSES BURNS. CAUSES RESPIRATORY TRACT IRRITATION. Do not get in eyes or on skin. Do not breathe dusts. Contact with other materials may cause fire. Wash thoroughly after handling. Keep container closed. Use with adequate ventilation. Keep from contact with clothing and other combustible materials.

Potential Health Effects

Eyes
Can cause severe eye injury. Contact can produce hardened, ulcer-like injury on eye. Conjuctivitis and bleeding may occur. In extreme

Continued on next page...

cases, cloudiness or discoloration of the cornea may occur.

Skin
Product acts as a highly corrosive agent to the skin. Contact may produce burns and/or tissue necrosis.

Ingestion
May irritate the mouth and throat. Fatal oral dose is estimated at 10 grams. Death may occur up to one month from the time of poisoning. Symptoms may include nausea, vomiting, stridor, slow pulse, and decreased blood pressure.

Inhalation
May irritate the nose, throat and respiratory tract. In severe cases, pulmonary edema may occur that could potentially lead to death. Other symptoms could include sore throat, coughing, shortness of breath, and difficult breathing.

Section 4 - FIRST AID MEASURES

Eyes
In case of contact with eyes, rinse immediately with plenty of water for at least 20 minutes and seek medical attention, after flushing eyes for 20 minutes.

Skin
For skin contact flush with large amounts of water while removing contaminated clothing. If irritation persists, get medical attention. Wash contaminated clothing before reuse.

Ingestion
If the material is swallowed, get immediate medical attention or advice -- Give several glasses of water or milk. Do not induce vomiting. Never give anything by mouth to a victim who is unconscious or is having convulsions.

Inhalation
If symptoms are experienced, remove source of contamination or move victim to fresh air.

Notes to Physician
Provide general supportive measures and treat symptomatically.

Section 5 - FIRE FIGHTING MEASURES

Flash Point	Method Used
Does not burn	Not applicable

UFL	LFL	Auto Ignition
Not applicable	Not applicable	Not applicable

Flammability Classification	Rate of Burning
Not applicable	Not applicable

General Fire Hazards
Potassium permanganate is an NFPA Class 2 Oxidizer. This is an oxidizing material that will increase the burning rate or cause a spontaneous ignition with a combustible material. Containers may

Continued on next page...

explode in fire.

Hazardous Combustion Products
Upon heating, oxygen will be released. Decomposition releases potassium oxides, manganese oxides.

Extinguishing Media
Use very large amounts of water as needed.

Fire Fighting Equipment/Instructions
Wear full set of approved protective gear for fighting fires.

NFPA Ratings: Fire: 0 **Health:** 1 **Reactivity:** 0 **Other:**

HMIS Ratings: Fire: 3 **Health:** 3 **Reactivity:** 3
Personal Protection: Goggles and/or face shield

Section 6 - ACCIDENTAL RELEASE MEASURES

Containment Procedures
Stop the flow of material, if this is without risk. Contain the discharged material. If sweeping of a contaminated area is necessary use a dust suppressant agent which does not react with product. (DO NOT USE SAWDUST)

Clean-Up Procedures
Wear appropriate protective equipment and clothing during clean-up. Shovel the material into waste container. Thoroughly wash the area with water after a spill or leak clean-up.

Evacuation Procedures
Evacuate the area promptly. Keep upwind of the spilled material and isolate exposure. Keep materials which can burn away from spilled material. In case of large spills, follow all facility emergency response procedures.

Special Instructions
Remove soiled clothing and launder before reuse. Avoid excessive skin contact with the spilled material. Have emergency equipment readily available.

Section 7 - HANDLING AND STORAGE

Procedures for Handling
Do not breathe dust. Do not get this material in your eyes, on your skin, or on your clothing. Use this product with adequate ventilation. Wash thoroughly after handling.

Recommended Storage Methods
Keep this material in a cool place. Keep the container tightly closed. Keep this material away from food, drink and animal feed. Do not store this material in open or unlabeled containers. Limit quantity of material stored.

Continued on next page...

MATERIAL SAFETY DATA SHEET

Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

Exposure Guidelines

A. General Product Information

Follow ACGIH recommended exposure limit of 0.2 mg/m3 TWA for manganese inorganic compounds (as Mn).

B. Component Exposure Limits

No ACGIH, NIOSH or OSHA exposure guidelines listed for this product's components.

Engineering Ctrl.: Use mechanical ventilation such as dilution and local exhaust. Use a corrosion-resistant ventilation system and exhaust directly to the outside. Supply ample air replacement. Provide dust collectors with explosion vents.

PERSONAL PROTECTIVE EQUIPMENT

Eye/Face: Wear chemical safety goggles and a face shield.

Skin: Wear impervious gloves, boots and coveralls to avoid skin contact.

Respiratory: For dust use a MSHA/NIOSH approved dust mask. For higher exposures use an approved supplied air respirator with a full facepiece operated in the positive pressure mode.

General: Have an eyewash fountain and safety shower available in the work area.

Section 9 - PHYSICAL & CHEMICAL PROPERTIES

Appearance	: Dark purple/bronze	**Odor**	: Odorless
Physical State	: Solid	**pH**	: Not available
Vapor Pressure	: Practically zero	**Vapor Density**	: Not applicable
Boiling Point	: Decomposes	**Freezing Point**	: Not available
Melting Point	: 464 deg F (240 deg C) decomposes	**Solubility (H20)**	: 6.4 g/100mL @ 20 deg C
Specific Gravity	: 2.70 @ 15 deg C (water=1)	**Particle Size**	: Not available
Softening Point	: Not available	**Evaporation Rate**	: Not applicable
Viscosity	: Not applicable	**Bulk Density**	: Not available
Percent Volatile	: Not available	**Molecular Weight**	: 158.04

Additional Properties

The data provided in this section is to be used for product safety handling purposes. Please refer to Product Data Sheets, Certificates of Conformity or Certificates of Analysis for chemical and physical data for determinations of quality and for formulation purposes.

Section 10 - CHEMICAL STABILITY & REACTIVITY INFORMATION

Chemical Stability: Solid is stable in air and light.

Conditions to Avoid: Keep away from materials which can burn.

Continued on next page...

Incompatibility
Organic materials - a reaction may cause fire
Reducing materials - a reaction may cause fire
Concentrated acids - may react violently and release toxic gases
Hydrogen peroxide - may react violently
Metals (Antimony, arsenic, titanium) - may react explosively
Explodes on contact with acetic acid; acetic anhydride; ammonium nitrate, dimethylformamide, formaldehyde, concentrated hydrochloric acid.

Hazardous Decomposition Products
Upon heating, oxygen is released, which increases potential of fire. Thermal decomposition products include potassium oxides and oxides of manganese.

Hazardous Polymerization
Will not occur.

Section 11 - TOXICOLOGICAL INFORMATION

Acute Toxicity/Target Organ Information

A. General Product/Component Information
Ingestion of this material may cause kidney and liver damage. Product is a known corrosive of the eyes and skin.

B. Component LD50/LC50
POTASSIUM PERMANGANATE (7722-64-7)
Oral, rat: LD50 = 1090 mg/kg

Epidemiology
No information available.

Carcinogenicity

A. General Product/Component Information
No information available.

B. Component Carcinogenicity Listings
None of this product's components are listed by ACGIH, IARC, NIOSH, NTP or OSHA.

Teratogenicity/Reproductive Effects
In animal studies manganese compounds were not teratogenic. Victims of manganese poisoning have reported impotence and decreased sexual desire.

Neurotoxicity
Combination of ingestion and inhalation can incur harmful effects on the central nervous system. Symptoms may include leg cramps, tremors, difficult walking, poor coordination, memory loss, questionable judgement and unstable emotions.

Mutagenicity
Potassium permanganate caused mutations in short-term tests of bacteria and mouse cells.

Other Information
None.

Continued on next page...

MATERIAL SAFETY
DATA SHEET

Material Name	**Page** : 5a
Potassium Permanganate	**Issue Date** : 2/15/1995
	MSDS No. : BCC-001

Section 10 - CHEMICAL STABILITY & REACTIVITY INFORMATION

Hazardous reactions may result when Potassium Permanganate comes in contact with certain other materials. These materials include, but are not limited to, the following:

Explosions may occur in contact with organic or readily oxidizable materials, either when dry or in solution.

Explodes on contact with acetic acid; acidic anhydride; ammonium nitrate; dimethylformamide; formaldehyde; concentrated hydrochloric acid; potassium chloride + sulfuric acid; sulfuric acid + water.

Forms sensitive explosive mixtures with aluminum powder + ammonium nitrate + glycerol nitrate + nitrocellulose; ammonium perchlorate; arsenic; phosphorus; sulfur; slag wool; titanium.

Ignites on contact with Al_4C_3; dimethyl sulfoxide; ethylene glycol; H_2S_3; HCl; H_2SO_4; (H_2SO_4 + organic matter); H_2SO_4 + KCl); NH_4ClO_4; NH_3; NH_4; NO_3; NH_3OH; organic matter; wood; oxygenated organic compounds (e.g., ethylene glycol; propane-1,2-diol; erythritol; mannitol; triethanolamine; 3-chloropropane-1,2-diol; acetaldehyde; isobutyraldehyde; benzaldehyde; acetylacetone; esters of ethylene glycol; lactic acid; acetic acid; oxalic acid).

Violent reaction or ignition under the proper conditions with acetone + tert-butylamine; alcohols + nitric acid; aluminum carbide; ammonia + sulfuric acid; antimony; coal + peroxomonosulfuric acid; dichloromethylsilane; dimethyl sulfoxide; ethanol + sulfuric acid; glycerol; concentrated hydrofluoric acid; hydrogen peroxide; hydrogen trisulfide; hydroxylamine; carbon; organic nitro compounds; polypropylene; 3,4,4'-trimethyldiphenyl sulfone.

Continued on next page...

MATERIAL SAFETY DATA SHEET

Section 12 - ECOLOGICAL INFORMATION

Ecotoxicity
Harmful to aquatic life in very low concentrations.
Environmental Fate
No food chain concentration potential.

Section 13 - DISPOSAL CONSIDERATIONS

US EPA Waste Number & Descriptions
A. General Product Information
If discarded, this product is considered a RCRA ignitable waste, D001.
B. Component Waste Numbers
No EPA Waste Numbers are applicable for this product's components.
Disposal Instructions
All wastes must be handled in accordance with local, state and federal regulations. This material can be converted to a less hazardous material by weak reducing agents followed by neutralization.

Section 14 - TRANSPORTATION INFORMATION

DOT Information
Shipping Name: Potassium Permanganate
Hazard Class: 5.1
UN/NA #: UN1490
Packing Group: II
Label(s) Required
OXIDIZER
Additional Shipping Information
In packagings of more than 100 pounds "RQ" is required in the shipping description.
International Transportation Regulations
NOTE: The data in this section (Section 14) is meant as a guide to the overall classification of the product. However, transportation classifications may be subject to change with changes in package size. Consult shipper requirements under I.M.O., I.C.A.O. (I.A.T.A.) and 49 CFR to assure regulatory compliance.

I.M.O. Classification: Potassium Permanganate, 5.1, UN1490, PGII, EmS No. 5.1-06, MFAG Table No. 715 (IMDG Code page 5173).

I.A.T.A. Classification: Potassium Permanganate, 5.1, UN1490, PGII (Passenger Aircraft maximum net quantity/package - 5 kg; Cargo Only Aircraft maximum net quantity/package - 25 kg

Canadian TDGA Classification: Potassium Permanganate, 5.1 (9.2), UN1490, PGII

Continued on next page...

MATERIAL SAFETY DATA SHEET

Section 15 - REGULATORY INFORMATION

US Federal Regulations

A. General Product Information

EPA Tier Two reporting classification: Immediate (Acute) = YES; Delayed (Chronic) = NO; Sudden Release of Pressure = NO; Fire = NO; Reactivity = YES

B. Component Information

This material contains one or more of the following chemicals required to be identified under SARA Section 302 (40 CFR 355 Appendix A), SARA Section 313 (40 CFR 372.65) and/or CERCLA (40 CFR 302.4):

POTASSIUM PERMANGANATE (7722-64-7, 98%)
CERCLA : final RQ = 100 pounds (45.4 kg)

All of this product's components are on the TSCA Inventory.

State Regulations

A. General Product Information

No components require labeling under California Proposition 65.

B. Component Information

The following components appear on one or more of the following state hazardous substance lists:

Component	Cas #	CA	FL	MA	MN	NJ	PA
POTASSIUM PERMANGANATE	7722-64-7	Y	Y	Y	N	Y	Y

Other Regulations

A. General Product Information

WHMIS Classification: C - oxidizing material; D - corrosive

B. Component Information

CANADA

The following components are identified under the Canadian Hazardous Products Act Ingredient Disclosure List:

Component	CAS #	%	Minimum Concentration
POTASSIUM PERMANGANATE	7722-64-7	98	1% item 1341 (1359)

Section 16 - OTHER INFORMATION

Other Information

All information, recommendations, and suggestions contained herein

Continued on next page...

MATERIAL SAFETY
DATA SHEET

regarding this product are based on data obtained from the manufacturers and/or recognized technical sources. However, Browning Chemical Corporation makes no warranty, expressed or implied as to its accuracy or completeness, and none is made as to the use of this product by others which is beyond our control. It is the users responsibility to determine the safety, toxicity, and suitability for his own application and use, handling and disposal of the product. The information in this MSDS relates only to the product designated herein and is not related to the use in combination, mixture, process or otherwise with any other material.

Revision Information: Issue 03/10/95 revises issue of 8/19/93; new 16 section format, literature review.

Key/Legend

EPA = Environmental Protection Agency; TSCA = Toxic Substance Control Act; ACGIH = American Conference of Governmental Industrial Hygienists; IARC = International Agency for Research on Cancer; NIOSH = National Institute for Occupational Safety and Health; NTP = National Toxicology Program; OSHA = Occupational Safety and Health Administration

TWA = 8 hour Time Weighted Average.

Contact Person: Nicholas P. DiGennaro **Phone:** (914) 686-0300

End of MSDS #BCC-001

Appendix N

Interagency Agreements/MOUs/MOAs

(to be included in revised plan)

Appendix O

Acronyms and Glossary

APPENDIX O
ACRONYMS AND GLOSSARY

Acronyms

AAR	After-Action Report
AIS	Aquatic Invasive Species
BAFF	BioAcoustic Fish Fence
Cfs	Cubic feet per second
COOP	Continuity of Operations
CSSC	Chicago Sanitary and Ship Canal
CWA	Clean Water Act
DNA	Deoxyribonucleic acid
DNR	Department of Natural Resources
eDNA	environmental DNA
EOC	Emergency Operation Center
EOP	Emergency Operation Plan
FEMA	Federal Emergency Management Agency
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
ft/sec	feet per second
GLNPO	Great Lakes National Program Office
GLFC	Great Lakes Fishery Commission
GIS	geographic information system
HSO	Health and Safety Officer
I&M	Illinois & Michigan
IAP	Incident Action Plan
IC	Incident Commander
ICS	Incident Command System
IDNR	Illinois Department of Natural Resources
IEPA	Illinois Environmental Protection Agency
IEMA	Illinois Emergency Management Agency
IJC	International Joint Commission
ILCS	Illinois Compiled Statutes
IPCB	Illinois Pollution Control Board
JIC	Joint Information Center
JIS	Joint Information System
KMnO4	Potassium permanganate
lbs	pounds
LL&D	Lockport Lock and Dam
LOFR	Liaison Officer (LOFR)

MOA	Memoranda of Agreement
MOU	Memoranda of Understanding
MSDS	material safety data sheets
MSU	Marine Safety Unit
MWRD	Metropolitan Water Reclamation district
NEPA	National Environmental Policy Act
NIMS	National Incident Management System
ORC	Office of Resource Conservation
POTW	Publicly Owned Treatment Work
PPE	Personal protective equipment
PIO	Public Information Officer
SOP	Standard operating procedures
SPA	Sound Projector Array
UC	Unified Command
UCS	Unified Command System
USC	United States Code
USCG	United States Coastal Guard
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USDA-APHIS	USDA Animal and Plant Health Inspection Service
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey

Glossary

Asian Carp
In the United Stated Asian carps are considered to be nuisance invasive species. The term "Asian carps", refer to four different species: grass, black, silver, and bighead carps. The bighead, silver and grass carp are native to eastern Asia and China. The black carp is native to eastern Asia, eastern Russia and Vietnam. Asian carps are a threat to the aquatic ecosystem because of their large size, reproductive success and ability to consume large amounts of food year round.

After-Action Report (AAR)
AARs are formal documents, intended to serve as aids to performance evaluation and improvement, by registering situation-response interactions, analyzing critical procedures, determining their effectiveness and efficiency, and proposing adjustments and recommendations.

Asian Carp Rapid Response Workgroup
The Asian Carp Rapid Response workgroup was created to assess the current situation and recommend courses of action should a rapid response be necessary to deal with Asian carp in areas of the Chicago Sanitary and Ship Canal, Des Plaines River, and the Illinois and Michigan Canal.

Aquatic Invasive Species (AIS)
AIS is a plant or animal that is non-native (or alien) to an aquatic ecosystem, and whose introduction is likely to cause economic, human health, or environmental damage in the aquatic ecosystem. Once established, it is extremely difficult to control their spread.

Aquatic Pesticide Applicator
Aquatic Pesticide Applicator supervises mixing and application on each boat according to the Site Safety plan. A certification is required to become an aquatic pesticide applicator. The applicator uses pesticides in or on standing or running waters for controlling pests.

AIS Rapid Response
If an invasive species is perceived to be an ecological or economic threat, a rapid response is implemented which involves plan for a successful eradication of the species.

Asian Carp Rapid Response Plan
Asian Carp Rapid Response Plan was created to assess the current situation and recommend courses of action to deal with Asian carp in areas of the Chicago Sanitary and Ship Canal, Des Plaines River, and the Illinois and Michigan Canal.

Acoustic barrier system
Acoustic barrier system is a method of using noise to prevent fish from entering water intakes. This system is a commonly used while abstracting water from rivers, estuaries and the sea, by power stations, hydro electric stations, pulp & paper factories, refineries, and off takes for drinking water, flood relief, inland waterways, fish farming and irrigation schemes.

Clean Water Act (CWA)
CWA is the primary federal law in the United States governing water pollution. CWA establishes the basic structure for regulating discharges of pollutants into the waters of the United States and regulating quality standards for surface waters.

Chicago Sanitary and Ship Canal
Historically known as the Chicago Drainage Canal, is the only shipping link between the Great Lakes (specifically Lake Michigan by the Chicago River) and the Mississippi River system, by way of the Illinois and Des Plaines Rivers. The canal also carries Chicago's treated sewage into the Des Plaines River. The canal is part of the Chicago Wastewater System, operated by the Metropolitan Water Reclamation District of Greater Chicago.

Illinois Department of Natural Resources Act (20 ILCS 801/1-15)
The IDNR Act Defines the function of Illinois Department of Natural Resources including its various rights, powers, duties, and functions.

Deoxyribonucleic acid (DNA)
DNA is a nucleic acid that contains the genetic instructions used in the development and functioning of all known living organisms and some viruses. The main role of DNA molecules is the long-term storage of hereditary information and passing on the information to the next generation.

eDNA testing/analysis
The method of testing for the presence of certain species within aquatic systems. Analysis involves obtaining DNA from mucoidal secretions, feces, or urine present within samples of water collected to detect fish species that were present in the water at the time of collection.

Electric Barrier System
It is an impassible barricade provided by electrical current passing through water to prevent fish from entering the water intakes. Two metal electrodes are submersed into the water with a voltage applied between them. The electric current passing through fish can evoke reaction ranging from a slight twitch to full paralysis.

Electrofishing
Electrofishing is a common scientific survey method used to sample fish populations to determine fish abundance, density, and species composition. Electrofishing uses electricity to stun fish before they are caught. When performed correctly, electrofishing results in no permanent harm to fish, which return to their natural state in as little as 2 minutes after being stunned.

Emergency Operations Center
An Emergency Operations Center provides necessary space and facilities for the centralized direction and control of the following activities: prevention of, preparedness for, response to, and recovery from terrorism, national disasters, and other major emergencies.

Emergency Operations Plan (EOP)
The purpose of the EOP is to align the capabilities and resources of City departments and staff into a unified all-hazards approach to local and regional incident management. This includes the prevention of, preparedness for, response to, and recovery from terrorism, national disasters, and other major emergencies.

Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)
The objective of FIFRA is to provide federal control of pesticide distribution, sale, and use. Under this law, all pesticides used in the United States must be registered (licensed) by the US Environmental Protection Agency. Registration assures that pesticides will be properly labeled and that, if used in accordance with specifications, they will not cause unreasonable harm to the environment. FIFRA provides EPA with the authority to oversee the sale and use of pesticides.

Geographical information system (GIS)
GIS is any information system that captures, stores, analyzes, manages, and presents data that is linked to a geographic location. GIS includes mapping software and its application with remote sensing, land surveying, aerial photography, mathematics, photogrammetry, geography, and tools that can be implemented with GIS software.

Health and Safety Officer
The HSO is responsible for overseeing and ensuring that response activities are free from health and safety hazards before, during, and after operations. The HSO also collaborates with the other Section Chiefs regarding resolutions of any safety issues.

Incident Action Plan
The strategic goals, tactical objectives, and support requirements for the incident. All incidents require an action plan. For simple incidents (Level I) the action plan is not usually in written form. Large or complex incidents (Level II or III) will require that the action plan be documented in writing.

Incident Commander
Incident Commander is the person responsible for all aspects of an emergency response; including quickly developing incident objectives, managing all incident operations, application of resources as well as responsibility for all persons involved. Incident Commander manages and controls the total operation of the response. The Incident Commander's responsibility is the overall management of the incident. On most incidents the command activity is carried out by a single Incident Commander.

Illinois & Michigan (I&M) Canal
Prior to construction of Chicago Sanitary and Ship Canal, the Illinois and Michigan Canal connected the Great Lake and the Mississippi River waterways for boat travel. The Illinois & Michigan Canal is a now-abandoned. The canal opened in 1848 and allowed for increased transportation to and from the Chicago area. Its use declined with construction of the CSSC, and all transportation operations ceased in 1933.

Incident Command System (ICS)
ICS is a set of personnel, policies, procedures, facilities, and equipment, integrated into a common organizational structure designed to improve emergency response operations of all types and complexities.

Incident Action Plan
An oral or written plan containing general objectives reflecting the overall strategy for managing an incident. It may include the identification of operational resources and assignments. It may also include attachments that provide direction and important information for management of the incident during one or more operational periods.

Interoperable Communications Systems
Communication system that provides the ability for two or more systems or components to exchange information and to use the information that has been exchanged.

Joint Information Center (JIC)
A Joint Information Center is a co-located group of representatives from local, state, federal and private organizations designated to handle public information needs during an incident or event. The JIC is designed to fit naturally into the Incident Command Structure and can be customized to reflect the size of the incident or event.

Joint Information System (JIS)
The purpose of the JIS is to provide a structure and system for developing and delivering coordinated interagency messages; developing, recommending, and executing public information plans and strategies on behalf of the IC; advising the IC concerning public affairs issues that could affect a response effort; and controlling rumors and inaccurate information that could undermine public confidence in the emergency response effort.

Liaison Officer
Liaison Officer are designated with incidents are multi-jurisdictional, or have several agencies involved. The Liaison Officer is the contact for the personnel assigned to the incident by assisting or cooperating agencies. These are personnel other than those on direct tactical assignments or those involved in a Unified Command.

Memoranda of understanding (MOU)
Memoranda of understanding is an agreement between two or more parties in the form of a legal document. It expresses a convergence of will between the parties, indicating an intended common line of action. It most often is used in cases where parties either do not imply a legal commitment or in situations where the parties cannot create a legally enforceable agreement.

Memoranda of agreement (MOA)
MOA is a document written between parties to cooperatively work together on an agreed upon project or meet an agreed upon objective. The purpose of an MOA is to have a written understanding of the agreement between parties. The MOA may also be a legal document that is binding and hold the parties responsible to their commitment or just a partnership agreement.

Material safety data sheets (MSDS)
MSDS is a form containing data regarding the properties of a particular substance. They are product safety information sheets prepared by manufacturers and marketers of products containing toxic chemicals. These sheets can be obtained by requesting them from the manufacturer or marketer.

National Environmental Policy Act (NEPA)
NEPA requires federal agencies to integrate environmental values into their decision making processes by considering the environmental impacts of their proposed actions and reasonable alternatives to those actions. To meet NEPA requirements federal agencies prepare a detailed statement known as an Environmental Impact Statement.

National Incident Management System (NIMS)
NIMS is a system used in the United States to coordinate emergency preparedness and incident management among various federal, state, and local agencies.

Preparedness Phase
This phase begins well in advance of implementing operations and signals the threat is imminent and conclude when the actual response is triggered. This phase includes planning functions necessary to carry out a rapid response.

Post-Response (Recovery) Phase
This phase begins with conclusion of water treatment and/or termination of the threat of Asian carp within the treatment area. This phase may begin during follow-up monitoring activities, which may continue well into recovery efforts. This phase ends with the After-Action Report and dissemination of lessons learned.

Publicly Owned Treatment Works
Publicly owned treatment works means any device or system for the treatment of pollutants owned by the State or any political subdivision thereof, any municipality, district, quasi-municipal corporation or other public entity.

Public Information Officers (PIO)
Information officer that coordinates media activities and information releases. PIO is responsible for overall coordination of public information activities and establish procedures for the dissemination of information. PIO provide the public with educational-type information for their safety and protection, disseminate public instruction and direction, and act as the government's point-of-contact with the news media.

Rapid Response Operation Phase
The Rapid Response Plan is a plan used in the early stages of disaster response. Rapid Response Operation phase include plan initiation, stakeholder notification, mobilization, treatment application. In addition, this phase would include initial follow-up monitoring of the problem area.

Safety Officer
The Safety Officer's function is to develop and recommend measures for assuring personnel safety, and to assess and/or anticipate hazardous and unsafe situations. Only one Safety Officer will be assigned for each incident. The Safety Officer may have assistants as necessary, and the assistants may also represent assisting agencies or jurisdictions.

Seine netting
A seine is a large fishing net that hangs vertically in the water by attaching weights along the bottom edge and floats along the top. Seine nets are usually long flat nets like a fence that are used to encircle a school of fish, with the boat driving around the fish in a circle.

Semi-oligotrophic system
It is a system that is lacking in plant nutrients and having a large amount of dissolved oxygen throughout in the pond or lake.

Site Safety Plan
Site Safety Plan describes the potential hazards of the work site, and includes all agency policies, controls and work practices selected to minimize those hazards.

Spill Containment plan
Spill containment plan describes planning, prevention and control measures to minimize impacts resulting from a spill.

Sound Projector Array driven BioAcoustic Fish Fence system (SPA-driven BAFF):
It is used as a deterrent system for fish. The system employs an air bubble curtain that contains a sound field which, when set at a particular frequency range for specific fish, emits a sound unpleasant enough for the fish so as to deter them from proceeding beyond the barrier.

Volume 33 Code of Federal Regulations Section 3.01
Provides general provision for the delegation of assigned function and public duties to U. S. Coastal Guard.

Unified Command (UC) System
The US is a structure that brings together the Incidents commanders of all major organizations involved in the incident in order to coordinate an effective response while at the same time carrying out their own jurisdictional responsibilities. Under the UC, the various jurisdictions and agencies and non-government responders may blend together throughout the operation to create an integrated response team.

Appendix P

References

APPENDIX P
REFERENCES

Barnhart, G. (2005, November 03). *The Threat Posed to the Great Lakes Basin by Asian Carp.* Retrieved from http://www.glfc.org/fishmgmt/testimony_AsianCarp.pdf

Canal Corridor Association. *I&M Canal History*. Retrieved (2009, October 15) from http://www.canalcor.org/CCA2005/CCA_Hist.html

Chick, J. H. Establishment of Asian Carp in the Upper Mississippi River and potential threats to the Great Lakes. Illinois Waterway Barrier Workshop hosted by the Great Lakes Protection Fund, in Chicago. June 2002.

Conlin, M. (2002, Summer/Fall). Asian carp poised to invade the great lakes. *News from the Great Lakes Panel on Aquatic Nuisance Species: ANS Update*, 8(3).

Friends of the Chicago River (2006). *Clean Water and Healthy Fish.* Retrieved (2009, September 15) from http://www.chicagoriver.org/projects/clean_water_and_healthy_fish/

Michigan Sea Grant. *Lake Sturgeon*. Retrieved (2009, September 02) from http://www.miseagrant.umich.edu/downloads/sturgeon/fs_Sturgeon.pdf

MacIsaac, H.J., Herborg, L., Mandrak, N. E., Cudmore, B. C. 2007. Comparative Distribution and Invasion Risk of Snakehead (Channidae) and Asian Carp (Cyprinidae) Species in North America. *Canadian Journal of Fisheries and Aquatic Sciences.* Vol. 64: 1723-1735.

Nico, L. G. 2009. *Mylopharyngodon piceus*. USGS Nonindigenous Aquatic Species Database, Gainesville, FL. Retrieved from http://nas.er.usgs.gov/queries/FactSheet.asp?speciesID=573. Revision Date: 7/20/2007

USGS - Florida Integrated Science Center. (2005, February 03). *Bighead carp*. Retrieved from http://fisc.er.usgs.gov/Carp_ID/html/hypophthalmichthys_nobilis.html